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OF

OPHTHALMOLOGY

AND

OTOLOGY.



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CONTENTS OF VOLUME VII. NUMBER I.

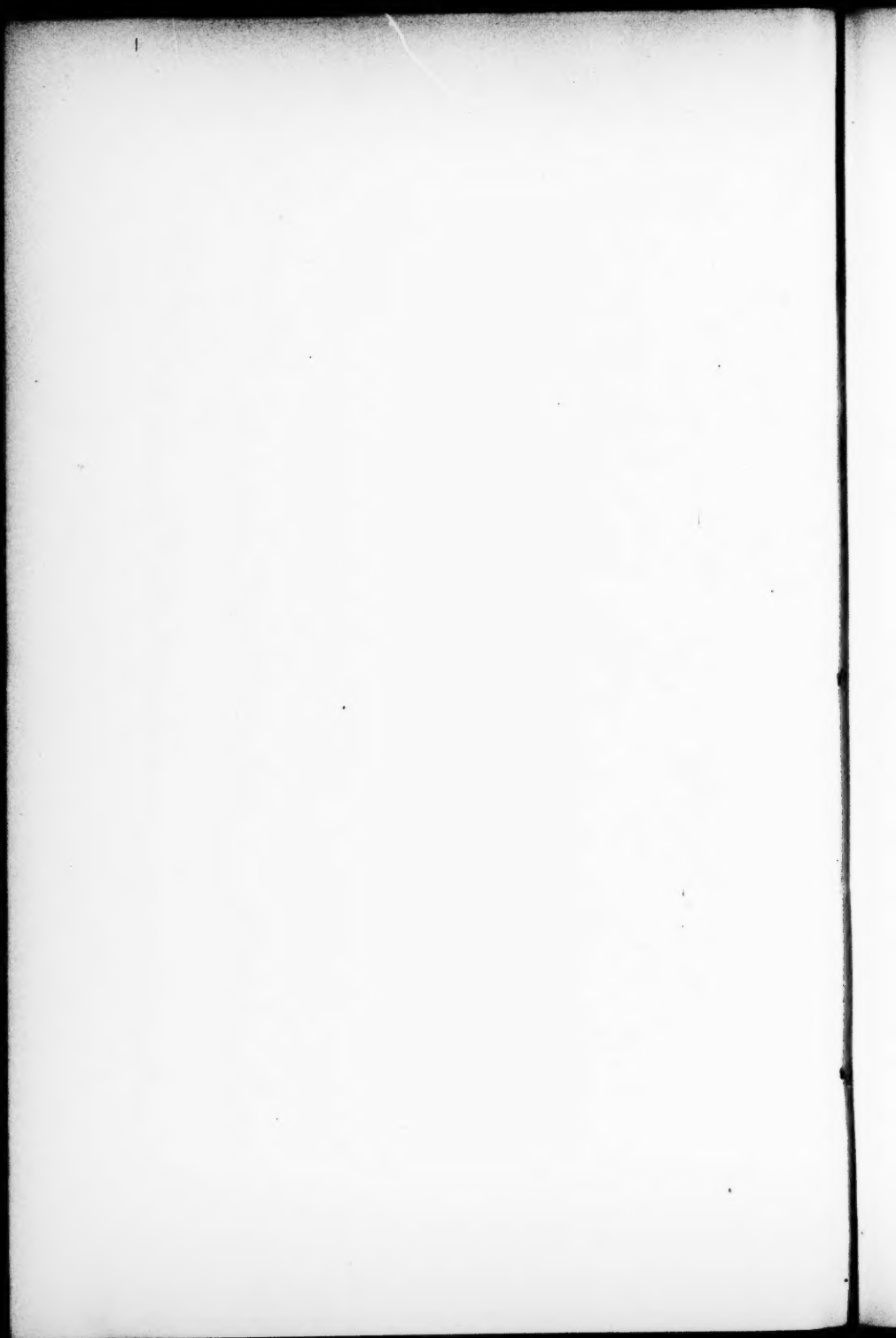
A.—OPHTHALMOLOGICAL PART.

	PAGE
1. Researches on the Microscopical Structure of the Cornea. By William Hassloch, of New York. (With Figs. 1-5, Plate I.).....	3-11
2. Contributions to the Knowledge of Glaucoma. By Prof. Dr. J. Schnabel, of Innsbruck. Translated by Dr. R. O. Born, of New York. First Article.....	12-38
3. Some Observations and Remarks on the Action of Eserin in Glaucoma. By H. Knapp.....	39-48
4. A Case of Spongy (Fibrinous) Irido-Choroiditis, affecting both Eyes at an Interval of Seven Months. By H. Knapp.....	49-52
5. On Peripheral Division of the Capsule in Morgagnian Cataract. By Dr. Emil Gruening, of New York.....	53-56
6. Ophthalmological Review. By E. Gruening and H. Knapp.....	57-69

B.—OTOLOGICAL PART.

1. Suppurative Otitis Media—Caries of Mastoid—Erosion of Veins at Base of Skull—Embolic Abscesses of Lungs—Pneumothorax Right—Death—Autopsy. By Dr. Cornelius Williams, of New York.....	73-76
2. On the Operative Treatment of Suppuration of the Ear. By Dr. Oscar Wolf, Frankfort-on-the-Main. Translated by James A. Spalding, M.D., Portland, Me. (With two woodcuts).....	77-108
3. Otological Review. By Clarence J. Blake, of Boston.....	109-118

OPHTHALMOLOGICAL PART.



RESEARCHES ON THE MICROSCOPICAL STRUCTURE OF THE CORNEA.

BY WILLIAM HASSLOCH, OF NEW YORK.

(With five drawings.)

It is generally acknowledged that the substantia propria of the cornea is made up of fibrils united into fascicles; that the majority of these bundles, by being more or less parallel to the surface of the cornea, form the laminated structure of the latter, at the same time crossing one another, and so giving rise to a kind of a lattice-work; while other fibres and bundles traverse the cornea in various directions. The fibrils, as well as the fascicles and lamellæ, are connected with one another by an intermediate cement substance, which somewhat differs from the fibrils in its chemical reaction.

But, concerning the relation of the protoplasm to the basis-substance, observers are of very different opinions. Some of them do not admit the existence of the protoplasmic bodies at all, asserting that within the basis-substance of the cornea only a tubular system is present, lined with "cell-plates." Other histologists hold the view that there is a certain quantity of protoplasm (cells of the cornea) inclosed in the "serous spaces," in which it ramifies, but which it does not completely fill. One of the most prominent advocates of the latter opinion is *W. Waldeyer* (article Cornea in *Graefe-Saemisch's Handbook*, 1874), deriving his views chiefly from the results of injections made by him and other recent observers into the tissue of the cornea. Fluids, pressed into the corneal parenchyma, produce, indeed, ramified figures resembling the "corneal corpuscles." *W. Kuehne*, *S. Stricker*, and *A. Rollett* state that there are complete corneal cells with protoplasmic bodies, with nuclei and nucle-

oli within the ramifying spaces, and that they fill these spaces completely. *W. Engelmann* denies the existence of preformed spaces inclosing corneal cells, etc. He states that there are spaces containing nothing but protoplasm, and this is in my opinion the only correct view, as I shall endeavor to prove.

In order to study the relation of the protoplasm to the basis-substance, I chose the cornea of the dog and of the cat, giving preference, after repeated trials, to that of the cat, as has previously been done by *S. Stricker*, on account of its easy splitting. With some practice one may succeed in obtaining lamellæ which present two or even only one layer of corneal corpuscles, and which, therefore, are sufficiently transparent to admit of being examined even with the highest powers of the microscope.

To stain the cornea, I at first tried nitrate of silver. The cornea of a cat was taken out immediately after death, and was put into a two-per-cent solution of nitrate of silver for one-half to one hour; then it was washed with distilled water, and, finally, for several days left under the influence of a very mild dilution of acetic acid. Instead of the acetic acid, in later experiments, I substituted lactic acid, which proved even more satisfactory than the former. After being prepared in this way, the cornea of the cat was ready to be split into lamellæ. The specimens were mounted with equal parts of glycerin and water.

With enlargements of 300-500 such lamellæ show on a dark ground—basis-substance—light fields with numerous connecting branches, generally known as *von Recklinghausen's* serous canaliculi; and even an enlargement of 500 is sufficient to prove that the outlines of these light spaces do not appear smooth at all, but granular, viz., abundantly perforated, and that the brown or gray-brown looking basis-substance is finely granular.

With higher powers (immersion lenses with enlargements of 800-1,200) the following facts (Fig. 1) are observed: Within the light spaces oblong nuclei with very faint contours and a great number of extremely pale granules are visible. The

light spaces are connected with their neighbors by light processes of various sizes, traversing the basis-substance. The borders of these light fields and of their branches are abundantly perforated, like a sieve, throughout, so that true outlines do not exist. Fine, light tracts run from every light space, and its branches through the basis-substance, profusely ramifying and anastomosing, sometimes radiating, and thus forming an extremely delicate, light network, the threads of which traverse the basis-substance in all directions and connect with the light fields and their processes at the whole circumference. What with lower power was recognized as granular structure was by higher enlargements elucidated as a very fine, light network, the meshes of which are filled by the dark-brown basis-substance.

On thin transverse sections (Fig. 4), the silver-stained cornea of the cat shows the same ramifying light fields as on split preparations, with the only difference that their vertical diameters are notably smaller, while their horizontal diameters are the same as those of the light fields of the lamellæ. The light spaces branch out in all directions, so that not only the light fields of the same stratum are connected with each other, but even those of different layers anastomose by ascending and descending—more or less oblique—processes. Besides these ramifications, especially in the outer strata of the cornea, some fine, straight, light lines are met with, which, for reasons given below, are proved to be nerve-fibres. Even on transverse sections the whole brown basis-substance is traversed by light, ramifying tracts to such an extent that the cement-substance cannot be distinguished from the other components of the cornea.

Further, I tried to stain the cornea of the dog and of the cat with chloride of gold. Many experiments which I made failed, though I had exposed the cornea to the influence of the chloride of gold for hours. The after-treatment with acetic acid and with tartaric acid gave only negative results. I could never see any distinct pictures of the corneal corpuscles with their ramifications until, at last, by the aid of lactic acid, I succeeded

in obtaining preparations of such beauty and of such clearness, that all doubt with regard to the finest structure of the cornea disappeared.

My method is the following: The cornea of a cat is taken out immediately after death, soaked in a ten-per-cent solution of lactic acid, and for a period of about twelve hours, then during one or two hours it is kept in a one-half-per-cent solution of chloride of gold, slightly acidulated by the addition of a few drops of lactic acid, and finally exposed to the influence of daylight. The superficial strata of the cornea and a peripheral border of 1 mm. turn yellow, and are of no use for examination, but the other part, the characteristic purplish tint of which shines through the yellow envelope, is invaluable for research.

After having made the above-described experiments, I learned that *J. S. W. Arnold*, of New York, had previously used lactic acid for the reduction of chloride of gold; but he informed me that his method differs from mine, inasmuch as he uses the chloride of gold in the first stage of the preparation, followed by the lactic acid, just the reverse of my plan of treatment.

The cornea of the cat, prepared after my method, splits readily, and its lamellæ, after turning dark enough by the influence of daylight, appear under the microscope throughout their whole extent strewn over with numerous, richly-ramifying, dark-violet corpuscles; in many of the latter the nuclei are distinctly visible; the corpuscles themselves crowded with dark granules; the basis-substance light, pale-violet, and also having a granular appearance. I have searched through a great many lamellæ, but I have never found any corpuscles that did not shoot off into branches; everywhere and always I met with only ramifying, dark-violet corpuscles with numerous connections and in different strata of varying sizes. The dark-violet fields fully coincide with the light spaces of the silver-stained cornea as to size, figure, and connections, as has been stated by *W. Kuehne*. The only difference is that in the silver preparation light fields are visible on a dark ground, while in the gold specimen the dark corpuscles appear on a light

ground—pictures which correspond with each other as the negative with the positive photograph.

Gold pictures examined with high powers (800–1,200) show that the dark-violet, ramifying corpuscles, without exception, have a retiform structure, and that the nucleoli, the contours of the nuclei, and all the granules are connected with one another by innumerable fine threads. The whole network is tinted equally dark-violet, while its extremely narrow meshes appear pale violet. The borders of the corpuscles and of their branches are nowhere distinct; contours in the real sense of the word are wanting in the gold picture as well as in the silver preparation, inasmuch as from the whole circumference of these ramifying, dark-violet fields, immense numbers of fine threads protrude, to join the neighboring dark-violet granules within the basis-substance. An examination of any portion of such a specimen will not fail to convince the observer that also in the basis-substance nearly all dark granules are connected with one another by fine threads. The cause of the difference between the shade of the corneal corpuscles and that of the basis-substance is, that in the former the granules are larger and lie close together, and that consequently the meshes are very small, while within the basis-substance the granules are mostly fine and more dispersed, and for this reason are separated from one another by larger meshes.

In some lamellæ, and, as it seemed to me, principally in the outer layers of the cornea, many corpuscles are connected with one another, not by broad branches, but by dark-violet, more or less straight lines, which for their characteristic, rosary-like structure must be considered non-medullated nerve-fibres (Fig. 3).

In profile (Fig. 5), the gold-stained cornea of the cat offers another proof of the coincidence of the positive gold picture with the negative silver preparation. Flat, elongated, dark-violet bodies are visible which, in the horizontal direction, anastomose with one another by means of fine, long processes; while broad, rather oblique, dark-violet branches ascend and descend to connect the corpuscles of different layers. The network of the dark fields and that of the basis-substance are shown with the

same clearness as in split preparations. The laminate structure of the cornea is as imperceptible in these transverse sections as it is in those of the silver-stained cornea.

On transverse sections of the gold-stained cornea of a dog I observed, especially in the central parts of the cornea, formations, which sufficiently explain the views of *W. Waldeyer*, who maintains that the corneal corpuscles do not completely fill the "serous spaces." There I saw groups of corneal corpuscles, which leaned mainly against one of the walls of the space, while a more or less considerable portion of the latter appeared empty. A closer examination, however, proved that these apparent voids are artificial products, namely, vacuoles. It can be observed that the eccentric cavity is situated *within* the corneal corpuscle, and on its whole circumference is inclosed by the protoplasm of the corneal corpuscle. No matter how thin the stripe of protoplasm which is interposed between the vacuole and the periphery of the "serous space" may be, it is always present. It is known that such vacuoles can arise from contraction of the living matter within the protoplasm. The question, why these contractions, perhaps as a result of the action of the chloride of gold, were observed only on certain groups of corneal corpuscles, remains unsolved. On the cornea of the cat I have never met with any formations of this kind.

From these observations it clearly follows: *that a tubular system, as described by von Recklinghausen, does not exist in the cornea at all.* The light fields, which the silver pictures of the cornea show, are not "serous spaces," but protoplasmic bodies, as stated by *W. Engelmann* and others, viz., spaces which are wholly filled with protoplasm. The strongest proof of this assertion is found in the result of the method of staining the cornea with chloride of gold, improved by the treatment with lactic acid, as it exhibits the corneal corpuscles in perfectly clear pictures, which in every particular completely correspond to the negative silver pictures. Whether an interstice filled with fluid remains between the wall of the so-called serous space and the protoplasmic body, or not, I will not yet venture to decide; but as the protoplasm itself contains a considerable amount of fluid, it is not at all necessary to admit

the presence of peripheral cavities filled with serum. Whenever an interspace between a corneal corpuscle and the wall of the "serous space" can be observed, its presence depends upon the formation of a vacuole, and cannot, therefore, be maintained in opposition to my view. Nor do the parenchymatous injections prove anything contrary to it; for it is apparent that colored fluids, which are forced into the protoplasmic spaces, will press the soft protoplasmic bodies against the walls of such spaces, and thus assume the principal forms of the latter.

My observations further show that the protoplasm of the corneal corpuscles has a retiform structure, which can be evidently demonstrated by the above-described method of staining the cornea with chloride of gold. The question, whether this method be an artefact or not should no longer be a matter of dispute, since, on the creeping amœba, on colorless blood-corpuscles, and on pus-corpuscles the same network has been demonstrated, and by photography made visible even to the naked eye. That this network (nucleoli, outline of the nucleus, granules, and connecting threads) is the living matter, the meshes of which inclose the lifeless protoplasmic fluid, is proved as well by the reaction of the chloride of gold, as also by the appearances observed in inflammation, which *S. Stricker* has so carefully studied and illustrated.

Finally, my observations show that the living matter thoroughly traverses the fibrous basis-substance of the cornea in the form of an exquisitely delicate network, the existence of which is proved beyond all doubt by the correspondence of the negative silver with the positive gold pictures, though in the fresh condition of the cornea it is as imperceptible as the corneal corpuscles themselves. If wandering bodies exist within the normal cornea—I have never met with them—such bodies will find their paths only within the cement-substance, never within the lamellæ; and as the lamellæ are connected with each other by innumerable fine threads of living matter, which penetrate the cement-substance—not taking into consideration the connecting, broad, oblique bundles of fibres—the reason why such wandering bodies move in zigzag lines is readily comprehended.

As for the finer structure of the cornea, I fully agree with *C. Heitzmann's* views regarding the connective tissue in general. The living connection of the protoplasmic bodies, which this observer has discovered in the myxomatous and the fibrillar connective tissue, as well as in that of the cartilage and of the bone, has been successfully demonstrated by me on the cornea also. The living matter presents within connective tissue two different networks: a narrow one, the meshes of which are filled with fluid—protoplasm—and another with broader meshes, traversing the basis-substance.

EXPLANATION OF THE DRAWINGS.

FIG. 1. Lamella of the cornea of a cat, aged one year and a half, stained with a two-per-cent solution of nitrate of silver. Two layers. Immers. $\times 1000$. *aa*, light fields with pale granular contents, with faintly marked nuclei, with coarse and fine processes, the latter radiating at *bb*. Every light field with perforated borders, and thus abundantly communicating with a delicate light network which traverses the whole dark-brown basis-substance in all directions.

FIG. 2. Lamella of the cornea of a cat, two years old, soaked in diluted lactic acid and then stained with a one-half-per-cent solution of chloride of gold. $\times 1000$. *aa*, dark-violet fields—corneal corpuscles—the nuclei of which are mostly covered, with processes of different sizes. The structure of the corneal corpuscles is retiform, as the dark-violet granules are connected with one another by fine threads of the same color. The corneal corpuscles and their processes abundantly connected with a dark-violet network which traverses the pale-violet basis-substance (*bb*). The latter network shows broader meshes than that of the corpuscles and of their branches.

FIG. 3. Lamella of a cornea of a cat, two years old, stained with a one-half-per-cent solution of chloride of gold, after having been soaked with diluted lactic acid. Immers. $\times 1000$. *aa*, dark-violet fields—corneal corpuscles—with only a few broad processes, but numerous dark-violet, thread-like connections—

non-medullated nerve-fibres (*bb*)—the latter partly traversing the corneal corpuscles, and partly joining the network of the same. Everywhere extremely fine retiform connections between the corneal corpuscles and the network of the basis-substance (*cc*) are present.

FIG. 4. Cornea of a cat, two years old, stained with nitrate of silver. Transverse section. $\times 1000$. *aa*, light fields containing fine, pale granules, with coarse and fine light processes, the latter (*bb*) corresponding to nerve-fibres. The dark-brown basis-substance (*cc*) traversed throughout by a light network.

FIG. 5. Cornea of a cat, two years old, stained with a one-half-per-cent solution of chloride of gold, after being treated with diluted lactic acid. Transverse section. $\times 1000$. *aa*, dark-violet fields, with broad branches and with fine processes, the latter (*bb*) nerves. The network of the dark fields everywhere in connection with that of the basis-substance (*cc*).

CONTRIBUTIONS TO THE KNOWLEDGE OF GLAUCOMA.

BY PROF. DR. J. SCHNABEL, IN INNSBRUCK.

Translated by DR. R. O. BORN, of New York.

First Article.

UPON the anatomical examinations of glaucomatous eyes, thus far published, I have, in my paper on Glaucoma and Iridectomy (Vol. V., part 1, of these ARCHIVES), pronounced the opinion that we have not yet succeeded in proving the supposition that the clinical picture of glaucomatous ophthalmia is a consequence of a choroidal inflammation.

Herewith agrees the remark of *Hermann Schmidt*, published shortly after writing my article, that the name of choroiditis serosa does not explain the process of the acute glaucoma, and that the special accentuation of the choroiditis is quite incorrect, since ophthalmoscopical examinations and the pathological anatomy show that of all parts of the eye the choroid is least affected.*

Since then, *Sattler* has published some observations on cases of chronic inflammatory glaucoma.†

These entitle us, in the cases examined from the anatomical standpoint, to assume the condition of the choroid as inflammatory; for in the capillary layer of the choroid, as well as in the more external unpigmented layer of fine elastic fibres, new cells in varying number could be demonstrated. But from the examinations we cannot derive a general conclusion in regard to the participation of the choroid in the glaucomatous process,

* Handbuch der gesammten Augenheilkunde von *Graefe* u. *Saemisch*, V. 1, p. 102.

† Anzeiger d. K. K. Gesellschaft d. Aerzte in Wien, vom 9. December 1875.

since *Klebs* says that the inflammatory changes in the choriocapillaris, upon which *Dr. Sattler* places especial importance, are indubitable complications of the process; that they are absent in recent cases of simple glaucoma, as he knows from his own examinations of numerous bulbi which he obtained from *v. Graefe*.*

The two latest publications on glaucoma are from *v. Wecker* and *Knies*. The former denies, as I do, the inflammatory character of the so-called inflammatory symptoms of the clinical picture;† the latter arrives at the conclusion that the glaucoma already, at a time when its diagnosis yet escapes the clinical examination, is prepared by an inflammation, and that also the so-called non-inflammatory glaucoma is only the result of an inflammation.‡ But *Knies* found a distinct infiltration of the choroid only in the latter stages of glaucoma, where the globe was already secondarily softened, or where, while the tension was yet increased, the cellular infiltration extended into all the tissues of the eye. Therefore he holds that the cellular infiltration of the choroid can only with difficulty be regarded as the principal feature of glaucoma, and he places the original seat, in many instances the only place of the inflammation, in the neighborhood of *Schlemm's* canal. The necessary consequence of an indurating inflammation which culminates in this region is, after *Knies*, the obliteration of *Fontana's* space, and then the increase of the intraocular pressure. From the existence of the obliteration of *Fontana's* space, *Knies* thinks he can account for a series of other symptoms till now taken for the results of pressure. These are the corneal opacities, the anæsthesia of the cornea, the iridoplegia, the apparent shallowness of the anterior chamber, the paresis of accommodation, and the hyperæmia of the anterior scleral veins.

According to *Knies*, the nervous influence is "certainly of great importance" only for the origin of the glaucomatous attack (l. c., p. 196).

* *Prager medicinische Wochenschrift*, 1876, No. 2, p. 45.

† *v. Wecker*, *Glaucom und Augendrainage*. *Arch. f. Ophth.* XXII., 4, p. 209.

‡ *Knies*, *Ueber das Glaucom*. *Arch. f. Ophth.*, XXII., 3, p. 163.

Following this view, the symptoms of glaucoma must—in analogy to *Donders'* theory—be traced back to two different sources: inflammation and anomalous innervation. But for the symptoms which *Donders* supposes to be a consequence of nervous disease, *Knies* claims an inflammatory origin, and the appearances in which, after *Donders*, the additional inflammation shows itself, *Knies* seems to refer to nervous irritation. I say “seems,” for from *Knies'* article it is not evident enough to me how far the author attributes the clinical picture of glaucoma to abnormal innervation. *Knies* says the glaucomatous attack is the result of anomalous nervous action. But the attack is not a distinct complex of certain symptoms, it is much more the form in which each symptom of glaucoma or each combination of symptoms may appear. By the sudden rise and fall of the symptoms, by the form of the attack, the clinical picture of glaucoma receives an exceedingly characteristic appearance, and every attempt to explain the glaucomatous process must consider this peculiarity; but it must be well remembered that there is not one symptom of glaucoma which appears only in a form of an attack, and not one which could not appear in such a form. It has been perfectly settled and is probably established for every specialist, that every one of the symptoms referred by *Knies* to the inflammation in the neighborhood of *Schlemm's* canal appears also as an attack, and this is especially well known of the two most important of those symptoms, viz., increase of pressure and corneal opacity, because attacks of these symptoms can be frequently observed during the course of a case.

Now, if the slow and steady development and the constant continuation of the glaucomatous symptoms are due to the inflammation near *Schlemm's* canal, but the sudden attacks to anomalous nervous action, the necessary consequence is that there are two, in fact, perfectly different processes, either of which can create and maintain each symptom of glaucoma and each group of symptoms, and that further both processes can exist in the same eye simultaneously and alternate to present the clinical picture. In fact, what I laid down as a

consequence of his doctrine, *Knies* pronounces distinctly in regard to the cardinal symptom of glaucoma, for he lets the pathological increase of pressure come from the obliteration of *Fontana's* space as well as from nervous influence (l. c., pp. 197 and 198).

It is therefore perfectly clear that the attempt to use *Knies'* theory for the clinical picture of glaucoma, which presumes that the neurotic theory is superfluous (l. c., p. 194), directly refers to the adoption of a primary neurotic nature of glaucoma; for although *Knies* ascribes only the "further" increase of pressure to nervous influence, we look in vain for an explanation why that agent should act only after the tension has already passed the normal, and why it should not also be able to produce the excess of tension.

When we try whether the view that the glaucomatous attack is caused by nervous influence is better adapted to the facts known; when we suppose that *Knies* by "attack" understands *Donders'* ophthalmia, we must first remark that among those symptoms which *Knies* refers to, the obliteration of *Fontana's* space, is also the corneal opacity, one of the most important symptoms of glaucomatous ophthalmia, and that there remains only pain and ciliary injection to prove the nervous irritation. Now these symptoms are frequent indeed, but not necessary for a glaucomatous attack, and we can observe the most exquisite attacks without any pain or ciliary injection. We are so much accustomed to connect with the name of acute glaucoma the idea of a so-called inflammatory glaucoma, that I do not fear it to be superfluous to refer here to the history of two cases of *acute, non-inflammatory* glaucoma.

Mrs. W., whose mother was taken ill with glaucoma some twenty years ago, is a very nervous, feeble lady, 36 years of age, who, as her family physician stated, suffers very frequently from the most horrible tonic and clonic convulsions. On June 7th, in the afternoon, when on the street, she suddenly became almost entirely blind. She hurried home, and the persons around her could not see anything else on the eye but "that a skin had grown over it." Also the family physician, when called, saw the opacity over the pupil. On June 8th, glaucoma

was already diagnosticated and the operation proposed. On the 11th, I saw the patient the first time. I found the tension very much increased, the cornea characteristically dull, the anterior chamber and pupil normal, the vitreous unchanged, the papilla not excavated, the arteries nicely pulsating, the veins of the retina enormously filled and tortuous. Fingers could be counted only at a distance of 5 to 6 feet, the field of vision was contracted from the outer side. Pain and ciliary injection were entirely absent. Since there could be no doubt as to the diagnosis, an inward iridectomy was made on June 11th. The healing process and the effect of the operation left nothing to be wished for.

On June 14th, patient complained that the right eye, still closed by a protecting bandage, was slightly painful and, after removing the bandage, the cornea seemed to me not quite transparent. The pupil was of normal size and movable, the depth of the anterior chamber unchanged, the tension increased. The acuteness of vision could not be tested, but the patient believed that now also with her right eye she saw worse than before the bandage was applied. On June 17th, until 11 A.M., the patient saw well with the right eye; then her vision became dim, and this increased so much that at an examination, made at 1 P.M., she could count fingers only at a distance of a few feet. Directly in front and toward the temporal side, the patient did not see at all, and the fingers could be counted only toward the periphery of the inner half of the visual field. The cornea was as opaque as I had seen it in the left eye before the iridectomy. *The anterior chamber had become shallower.* The pupil was of normal width and reacted promptly to the light. The vitreous, seen by the ophthalmoscope, appeared unchanged. The papilla was reddened, the central artery pulsated distinctly, the veins were strongly filled. The hardness of the eyeball was very great. There was no pain at all. On June 18th, also in the right eye an inward iridectomy was made. On that day, I found the chamber still shallower than on the day before. The other symptoms were unchanged. The effect of the operation was perfect. At the end of the year 1876, I saw the patient again; the colobomas were the only visible consequence of her disease.

2. *Peter H.*, 76 years old, a yet tolerably vigorous man, who lost the sight of his left eye by glaucoma more than ten years ago, was reading his newspaper on February 11th, 1876, at 10½ P.M., and went to bed on account of a slight uneasiness, combined with a chilly feeling. When

he awoke after a well-passed night, he was almost entirely blind. The window appeared to him as a light spot, and he endeavored in vain to recognize the largest objects. Before this disastrous morning, the careful and reliable patient (who was still working as a tailor) had not the least cause to complain of his right eye. During the following day his condition remained unchanged. He experienced no pain, and only after repeated inquiries he was compelled to state that he had noticed some heaviness in his head. The next night was quiet, and on the morning of the 13th, he could distinguish the window-frame from the lighter glasses. On the evening of the 13th, he was transferred to *v. Jaeger's* ophthalmic wards. At an examination made immediately, *Dr. Herzen-dorfer* found the cornea quite opaque with perfectly good reflection, the size of the pupil normal, the intraocular pressure much increased, the acuteness of vision reduced to quantitative perception of light. In the morning of the 14th, the patient could see again; in this state I examined him the first time. The tension was but little above the normal; with $-\frac{1}{30}$ S. = $\frac{20}{100}$, with $+\frac{1}{8}$, he read No. 3; the field of vision normal. The cornea perfectly transparent and reflecting; the conjunctiva bulbi very little injected, the lower conjunctival fold slightly œdematous, the iris of normal color, the pupil of normal size, the anterior chamber of normal depth, the lens strongly reflecting, but the images of the mirror well seen; numerous small, fixed opacities containing cholesterine in the vitreous, rendering the inspection of the papilla difficult. The latter is reddened, the veins strikingly large, the arteries relatively small. No trace of an excavation.

On the 15th at noon, the patient again became suddenly so blind that he could not see the persons around him. This blindness continued for an hour. Shortly after it had ceased, I found the bulbus very hard, the size of the pupil and the depth of the anterior chamber normal; the cornea reflecting, and in its centre a grayish, sharply defined opacity of rhomboidal shape. Of the fundus I could only see here and there a piece of a vessel, S. = $\frac{20}{100}$. Pain was entirely absent. On the morning of the 16th, an inward iridectomy was performed. Course of operation and healing, as well as the effect of the operation, were good. An excavation was not formed.

[Although there is no immediate connection, I may yet be permitted to mention here a case in which I observed the outbreak of acute glaucoma after atropine-instillation. It is hardly necessary to give new evi-

dence of the real existence of a casual connection between the instillation of atropine and the glaucomatous attack. But my observation may deserve to be specially mentioned, because it contains one feature which distinguishes it from all the other similar observations hitherto known, and which might later be of some importance for an explanation of that remarkable influence of the atropine.

Moritz P., 60 years old, was admitted to *v. Jaeger's* clinic on February 8th, 1876, for glaucoma o. d. The eyeball was extremely hard, the cornea so opaque that of the fundus nothing could be seen, the pupil of medium size, immovable. Pain absent. Fingers counted at 6'. Considerable limitation of visual field inward.

The left eye showed no other anomaly, but a dirty, grayish-green discoloration of the optic disc. The desire to examine this nerve accurately, led me to instil a solution of atropine of 1 : 2,500 to dilate the too narrow pupil. This was done on Feb. 8th, at 4 P.M. About three hours later, after the pupil had slowly and moderately dilated, the patient felt bad, had pain in the head and around the left eye, and lost the sight in it. When I saw him again the next morning, about 19 hours after the instillation of the weak solution of atropine, he complained that he had not slept during the night, had vomitted five times, and that the left eye was very dim. The left cornea was now like the right; the fundus could not be seen. The depth of the anterior chamber was not changed by the glaucomatous attack. The tension abnormally great. Twenty-four hours after the instillation, the pupil had again become considerably narrower. Forty-two hours after the atropine had been used, the iridectomy was made, since the eye had already a distinct glaucomatous habitus, and his sight had been reduced to the counting of fingers at 8'.]

Now, this is the report of three eyes in which acute glaucoma caused only such symptoms as *Knies* derives from the obliteration of *Fontana's* space, *i. e.*, increase of tension with its consequences, corneal opacity, and shallowness of the anterior chamber. The attempt to apply *Knies'* theory to these cases brings this theory into indissoluble contradictions with itself.

Before I proceed to the discussion of the anatomical changes upon which *Knies* bases his theory, it seems necessary to me to

settle what is meant by the somewhat indifferent term: "Inflammation in the neighborhood of *Schlemm's* canal" and "Obliteration of *Fontana's* space."

It is known that *Schlemm's* canal is situated very near the corneal margin, between the two surfaces of the sclerotic. It is, however, not imbedded in the scleral tissue itself, but takes its course in a channel-like excavation of the posterior scleral surface which lies between the margin of Descemet's membrane and the ciliary muscle, and is filled chiefly by a number of sieve-like perforated lamellæ which are placed above each other.

Schwalbe says that *Schlemm's* canal is formed simply by the scleral channel being covered by those lamellæ, and that the bottom of the channel becomes the anterior wall of *Schlemm's* canal.* This picture explains the relations of the parts admirably; it could, however, as *Waldeyer* remarks, easily lead to the wrong idea of two different tissues composing the *canalis Schlemmii*.† In accordance with *Waldeyer*, I find that also the anterior wall of *Schlemm's* canal is not directly formed by the sclerotic, but by a thin layer of the same cavernous tissue which separates the canal from the anterior chamber. In meridional cuts of the sclero-cornea, the canal has generally the form of a transverse section of a lens. It presents a fissure which gapes mostly in the middle, which with one point reaches not fully the margin of Descemet's membrane, and with the other extends very little farther towards the equator than the insertion of the ciliary muscle on the sclera. Hence, it has only an anterior and a posterior wall, and is surrounded on all sides by the tissue filling the scleral channel. The latter is a portion of that peculiar lamellated and columnar tissue which fills the space between the margin of Descemet's membrane, ciliary muscle, and insertion of iris on one side, and the sclero-cornea and ligamentum pectinatum iridis on the other, and which corresponds to the region of the ox's eye described by *Fontana* as

* *Schwalbe*, Untersuchungen über die Lymphbahnen des Auges und ihre Begrenzungen. *Schultze's Archiv f. microscop. Anatomie*, VI., p. 301.

† *Handbuch der ges. Augenheilkunde von Graefe und Saemisch*, I., p. 229.

a new canal of the eye. Again, *Fontana's* canal as an annular cavity with definite walls we now know is only artificially produced by the mechanical destruction of the loose columnar tissue, the numerous communicating cavernæ inclosed between the columns being united.* It is therefore more correct to speak of *Fontana's* space, understanding by this name the whole region, including its columnæ and cavities. If we accept this term, then we must also in the human eye speak of a *Fontana's* space. Within it lies *Schlemm's* canal, and whatever is said about the surroundings of this canal means the tissue of *Fontana's* space. *Knies*, however, adheres to another view, since he differentiates between *Fontana's* space and the parts around *Schlemm's* canal. Thus, in a description of a case, he says that the neighborhood of *Schlemm's* canal was pervaded by cells (l. c., p. 167), while *Fontana's* space was yet well preserved and normal throughout (l. c., p. 194). Furthermore, he assumes that *Fontana's* space is a cavity, since he speaks of its obliteration. Some authors, however, though rejecting the hypothesis of *Fontana*, yet mean a cavity when speaking of *Fontana's* space. They call so the cavernæ between that peculiar loose columnar tissue before mentioned, and consequently speak of *Fontana's* spaces.† In the human eye, however, larger spaces in this columnar tissue do not regularly occur, and "generally man has no *Fontana's* spaces" (Waldeyer, l. c., p. 229).

Knies, who calls *Fontana's* space a cavity with definite walls existing in every human eye, who, in order to demonstrate that already *Heinrich Müller* had known the obliteration of *Fontana's* space, refers to a passage where that author speaks of an agglutination of the walls of the anterior chamber, apparently denotes by that name the peripheral parts of the anterior chamber.

It is a maxim which facilitates essentially clearness, not to use a customary name in a sense fundamentally different

* *Iwanoff* und *Rollett*, Bemerkungen zur Anatomie der Irisanheftung und des Annulus ciliaris, Arch. f. Ophth., XV., 1, p. 51.

† Handbuch d. ges. Augenheilkunde von *Graefe* und *Saemisch*, I. Abbildung auf p. 266.

from the one generally applied. Therefore, I shall, in the following remarks, instead of inflammation in the neighborhood of Schlemm's canal, which causes the obliteration of *Fontana's* space, say, inflammation of the columnar tissue of *Fontana's* space, which leads to the obliteration of the sinus inclosed by the most peripheral parts of the walls of the anterior chamber.

If we imagine a cylinder erected in a normal eye, on the basis of a plane passing through the margin of Descemet's membrane, and its circumference coinciding with that margin, and if we suppose the surface of the cylinder to extend posteriorly to the plane of the iris, there remains between the surface of the cylinder and the lateral wall of the chamber an annular space, which is limited behind by the iris, in front by the ligamentum pectinatum. This space, as has been often noted, is generally missing in glaucomatous eyes; here the periphery of the anterior chamber coincides with the margin of Descemet's membrane, or it is even smaller than the circumference of that membrane. The anterior and posterior wall of the anterior chamber meet directly; its lateral wall disappears. The sinus of the chamber is replaced by a real margin of the chamber. *Schlemm's* canal which, in meridional sections of normal eyes, lies opposite the lumen of the chamber in its whole length, is in the glaucomatous eye posterior to the margin of the chamber, even with its corneal end. Only a short time ago this change of form of the anterior chamber was explained by the opinion that, by pathological increase of intraocular tension, the iris was pressed against the anterior wall of the chamber.* Thus it was, analogous to the displacement of the lamina cribrosa, taken for a change of position caused by the anomaly of pressure, and no consequence was ascribed to it in regard to the further course of the process and the formation of the clinical picture of glaucoma. Not the knowledge of the changes, constantly found by *Knies*, but their interpreta-

* *H. Pagenstecher*, Ueber Erweiterung des sog. *Petit'schen* Canals, etc. Arch. f. Ophth., XXII., 2, p. 292.

tion is new, and only to the latter refer the following considerations. Their object is to decide:

1. Whether the obliteration of the sinus of the chamber is characteristic of glaucoma, and only found in this disease.

2. Whether the infiltration of the columnar tissue in *Fontana's* space is peculiar to glaucoma.

3. Whether this infiltration has to be regarded as the result of an inflammation of this tissue.

4. Whether the obliteration of the sinus of the chamber has to be looked upon as a consequence of this inflammation, or how else it does take place.

5. Whether it is necessary that glaucomatous symptoms follow the infiltration of the columnar tissue of *Fontana's* space and the obliteration of the sinus of the anterior chamber.

I.

The agglutination of the surface of the iris to the opposite anterior wall of the chamber in its most peripheral portions I have constantly found in all those eyes examined by me, in which the iris had healed into a perforating wound of the cornea. The age of the individual and the refraction of the affected eye did not influence that agglutination. It is also indifferent for its formation, whether the corneal cicatrix is large or small, central or marginal; whether the cornea, resp. the new-formed cicatricial tissue, has retained its normal curvature, or whether it has become bulged or flattened; whether the corneal circumference remained normal, grew larger or smaller, and, finally, whether the intraocular tension is increased, normal, or decreased. In those cases where the entire pupillary margin, or a circle of iris concentric to it, was held in the corneal cicatrix, I found also the surface of the iris in its whole circumference attached to the ligamentum pectinatum. But when only a portion of the pupillary margin, or of a concentric circle of the iris, had healed in the cornea, there was also only the peripheral portion of iris, corresponding to the anterior synechia, agglutinated to the

cornea. Generally the adherence to the walls of the chamber extended to the margin of Descemet's membrane; sometimes it did not reach it, in some cases it extended beyond it, and I found a circle of the *membrana Descemetii* 1 to 2 mm. broad, in contact with the corresponding surface of the iris. Between the two agglutinated walls of the chamber I have never seen any pathological, new-formed tissue; also after separating the pathological adherence, I could never observe a tissue which did not belong to the normal constituent parts of the iris or the *ligamentum pectinatum*.

The adhesion showed different degrees of firmness.

The attempt to separate the sclero-cornea from the choroidea-iris never showed a clean smooth surface of the formerly united tissues. To the iris always adhered some columns of the *ligamentum pectinatum*, to the latter cells of the iris-tissue. Before the connection was perfectly interrupted, I saw between the two agglutinated surfaces bands of the *ligamentum pectinatum*, covered with cells of the iris, extend as a variously formed bridge. Sometimes I saw Descemet's membrane detached from the cornea and remaining connected with the iris. In two eyes, in which the obliteration of the sinus of the chamber was circular and the iridectomy had been made, I found the adherence except in the part corresponding to the coloboma. This was not effected by the knife, for the inner wound was in Descemet's membrane, and the attachment had only extended to its margin. The traction on the iris at its exsection had loosened the abnormal connection. This traction was in one case (1, *a*), certainly not forcible, as was shown by the position of the processus and the stump of iris; in the second case (2), the processus were pulled considerably toward the axis of the eye, and a strong traction must have been exerted. Another circumstance, however, in this case demonstrated that it did not require a great effort to separate the connection between cornea and iris, since it was also loosened by an extravasation into the anterior chamber.

The columns of the fenestrated lamellæ, which bridge over the scleral channel, showed frequently a perfectly normal con-

dition. Sometimes the lamellæ were pressed together so much that I missed the spaces between them. Between the lamellæ and their meshes, up to the walls of Schlemm's canal, I found frequently pigment in single granules, or in irregular heaps of varying form and size, or imbedded in cells of the character of lymphoid corpuscles. Also white and red blood-corpuscles in varying number were sometimes found in the columnar tissue of the scleral channel, between its lamellæ up to the margin of Descemet's membrane and between the columns into which it blends, at the origin and the inner surface of the ciliary muscle.

Schlemm's canal showed in meridional sections mostly the normal form of a fissure, and nothing was found between the endothelial coverings of its walls. Sometimes its lumen was narrowed or even perfectly destroyed.

The piece of iris which was attached showed in some cases normal texture and density, in others it was pervaded by pus and blood-corpuscles, in others free from inflammatory products, but very much thinned, leaving only the pigmentary layer of the posterior surface. The thickness of the corresponding piece of iris was sometimes normal, and its anterior surface simply joined closely the inner and anterior wall, following its curvature; sometimes the origin of the iris was found thicker than normal, but loosened, the spongy iris attached at its surface and sinking by its gravity, apparently stretched from in front backwards. The surface presented in these cases a wave-like appearance with pointed projections. Sometimes the origin of the iris was enormously thinned and transformed into a thin sheet.

The sclerotica around the scleral channel, as well as the ciliary body, showed no changes which could not have been brought in direct connection with the adhesion of the walls of the chamber.

1. *Alois Brandeker*, 26 years of age, was treated in *v. Jaeger's* clinic, from October 24th, 1871, to March 12th, 1872, for a gonorrhœal ophthalmia of both eyes, which brought on extensive ulceration of both

corneæ, with perforation and prolapse of iris. On May 4th, a *superficial* central leucoma with indistinct margins and extensive adhesion of iris was ascertained in the *right* eye. The pupil was not visible. Fingers were counted at $1\frac{1}{2}'$. In the *left* eye the cicatrix was at that time *bulging*, the iris around it adherent. Outwards a space of cornea, a little more than $1'''$ in breadth, remained transparent, in all other directions it was only a little over $\frac{1}{2}'''$. On May 6th, 1872, an inward iridectomy was made in the left eye. The healing process was perfectly normal, and the patient could leave the hospital by May 10th. He then counted fingers at 5'.

On April 23d, 1874, *Brandeker* died of pulmonary tuberculosis, and I enucleated the eyes nine hours after his death.

a. Right globe. Length of axis 21.3 mm., horizontal diameter 20.7 mm., vertical diameter 21 mm., diameter of cornea 10.5 mm. The immense cicatricial opacity of the cornea is nearly round, is about 6 mm. in diameter, and lies in the level of the normal cornea. The iris corresponding to this cicatrix attached to the posterior corneal surface. The space of the cicatrix is, from within, cup-like, and corresponding to the excavation thinned to one-half of the normal thickness of the cornea. The uveal pigment appears normal. With the magnifying glass nothing abnormal can be seen on the ciliary processes. The cicatrix of the iridectomy I could not detect on the outside, not even with the magnifying glass. Next to the process the coloboma measures $4\frac{1}{2}$ mm., and in its opening are 15 ciliary processes which are entirely like their neighbors. The ligamentum pectinatum is in its whole length attached to the surface of the iris. Only at the site of the coloboma they are not grown together. The optic nerve is not excavated.

Microscopical Examination.—There is no space between anterior surface of iris and ligamentum pectinatum. Only at the coloboma exists a small sinus between the stump of the iris and the anterior wall of the chamber; but here distinct traces of a former agglutination of both surfaces are present. In the first place, the concave inner side of the sinus of the chamber is everywhere yet connected with the tissue of the iris; further,

frequently point-like projections of iris rise above the anterior surface of the stump, the points of which are directed toward the ligamentum pectinatum; finally the latter itself is throughout covered with remainders of iris-tissue. The agglutination extends nearly to the margin of Descemet's membrane, and is not effected by an interposed substance. At its attachment, the iris is thicker than normal. This condition is not the result of real increase in volume, but of stretching, as can be seen from the different direction of the pigmented cells in that portion, its long processes being directed toward the cornea, resp. the posterior surface of the cornea. Very near the end of the ligamentum pectinatum, the anterior plane of the iris sinks into the normal level, thereby forming a point in the profile of the section of the iris, which is adherent to the cornea. From this point toward the centre of the cornea—gradually more and more scanty—pigmented cells of iris are found. All possible forms of connection between iris and ligamentum pectinatum are seen in the different preparations. There is not in all of them a joining of the surfaces; in many we observe columnæ of the ligamentum pectinatum either with or without iris-cells, approaching the iris in an oblique direction and uniting with it. In these cases, manifestly, the adhesion has been too weak to retain the iris permanently in that unnatural position. Very similar preparations can be obtained by slightly separating the iris from the cornea in meridional sections, in which a perfect adhesion of the surfaces exists. Neither the iris nor any part contributing to the formation of the periphery of the chamber show imbedded cells. The lamellæ which overhang the canalis Schlemmii and its columns are perfectly normal. Schlemm's canal everywhere gaping and emptied, presenting generally a simple split pointed on both ends; in meridional sections the ends are rarely dilated into sinuses or are bifurcated. Sometimes the aperture of Schlemm's canal is by bridges divided into three to four oblong openings.

b. Left bulbus. The ectasia of the corneal cicatrix, which was observed on the living at an examination on May 4th, 1872, could no longer be detected in the dead eye. The proportions

in the eyeball were the same as in the right. The margin of corneal tissue preserved was smaller than in the right. In the section, the distance of the base of the iris from the nearest point of attachment was 2.640 mm. The iris is adherent, not only to the ligamentum pectinatum, but also to a small circle of Descemet's membrane. Where the membrana Descemetii begins to be separated into the lamellæ, there is a notch in the posterior surface of the cornea into which the iris is pulled, and there retained in the form of a pointed elevation. The insertion of the iris is thinned. The thinning is mostly marked at the insertion, and disappears gradually toward the free margin. Meridional sections of the iris have consequently a triangular form with the obtuse point at the ciliary body. In some meridional sections only the uveal layer of the iris is preserved. In preparations in which the iris has been separated from the cornea, the columns of the ligamentum pectinatum remain connected with the iris, and extend obliquely from the cornea to the iris, blending together with its anterior surface. The lamellæ at the scleral margin are pressed closely together. Between them lie numerous small heaps of pigment. An open canal of Schlemm is wanting almost throughout; only in a few meridional sections there are two or three small openings in the situation of Schlemm's canal. Neither in the columns of Fontana's space, nor in the iris, or in the ciliary body, or in the sclerocornea, is there a trace of cellular infiltration. The level of the optic disc is normal.

2. *Joseph Peibel*, 56 years old, lost the sight of the right eye in consequence of an inflammation in November, 1873. On October 17th, 1874, a white cicatrix was visible in the lower half of the cornea, which extended into the pupillary space. The lower portion of the iris was adherent to the cicatrix. The pupil, irregular by numerous posterior synechiæ, was dilated very little by atropine. The lens cataractous, and attached to the iris and cornea. The tension of the eyeball below normal, sight reduced to quantitative perception of light. External signs of a preceding inflammation were entirely missing. The left eye showed no abnormality, neither by external nor by ophthalmoscopic examination; S. = $\frac{2}{80}$.

On October 24th, 1874, an inward and upward iridectomy was made in the right eye. October 26th : pain in the operated eye, effusion of blood into the anterior chamber. October 27th : pain has disappeared. October 30th : the blood in chamber unchanged ; the wound closed. October 31st : patient died at 4½ P.M. The autopsy showed chronic Bright's disease with eccentric hypertrophy of the heart, œdema of the brain and lungs.

The anatomical examination of the eye showed the pupil perfectly closed by a membrane, which was attached to the lens as well as to the corneal cicatrix. One-fourth of the iris was cut out. In some meridional sections the iris appeared attached to the ligamentum pectinatum, up to the margin of Descemet's membrane. In some sections the anterior surface of the iris had an eminence which was imbedded and retained in a depression at the margin of Descemet's membrane. Outwards from this point of attachment the iris was again either perfectly free, or single threads extended from the ligamentum pectinatum to the anterior surface of the iris. Some sections showed the iris closely joined and attached only to the inner wall of the chamber, but the part of the ligamentum pectinatum next to the corneo-sclera did not adhere to the iris. In these sections the iris had approached the cornea to such an extent that the anterior surface of its insertion was situated in the same plane with the scleral surface of the ciliary muscle, and opposite the margin of Descemet's membrane was a pointed eminence in the profile of the iris, which, however, did not reach the cornea. No attachment between stump of iris and ligamentum pectinatum ; the former drawn far away toward the axis of the eye. Red blood-corpuscles in considerable quantities were lying between the layers of the ligamentum pectinatum, between the single fascicles of the tendon of the tensor, between the columns of *Fontana's* space, on the anterior surface of the iris, and in the tissue of its insertion, and also in that of the ciliary muscle. The weight of the blood then had partially loosened the circular attachment of the iris and the ligamentum pectinatum which had manifestly existed before. In most of the sections *Schlemm's* canal was gaping and emptied. In many I found

isolated blood-corpuscles in it, and in some it was even densely filled with red blood-globules. None of the tissues comprising the angle of the iris had undergone a purulent infiltration. The level of the optic disc was normal.

3. *Johann Pemsel*, 25 years of age. The right eye was enucleated during life on November 4th, 1873; the left on April 22d, 1874, after death. The latter was perfectly normal. The clinical history of the former remained unfortunately unknown to me.

The size and form of the right eyeball do not differ from the normal. The cornea has a horizontal diameter of 10 mm., and has in its centre a very dense, white, disciform cicatrix of more than 5 mm. diameter in its normal level. The thickness of the cicatrix is 3 mm. in the centre. The cornea around the cicatrix appears normal. The pupil is irregularly oval, perfectly adherent to the corneal cicatrix, which from behind through the pupil looks as white as chalk. The iris presents nothing striking on its posterior surface; the radiation, the pigmentary layer are the same as in the normal eye. There exists, then, an attachment of the anterior surface of the iris around the pupil to the posterior surface of the corneal cicatrix, and to the circle of normal cornea corresponds also a circular chamber around the immense synechia. The processus ciliares normal in situation and form. The lens in normal position, with a depression of its anterior surface at the pupillary space. In meridional sections the iris was again seen agglutinated to the ligamentum pectinatum. In several sections the attachment does not reach the margin of Descemet's membrane; in not one does it extend beyond it. The insertion of the iris is perfectly normal in thickness and structure and not at all stretched. It forms an arch convex in front in meridional sections, since its anterior surface joins the inner and anterior wall of the chamber. The connection is loose. In many sections the iris is depressed, and the ligamentum pectinatum and the separated posterior lamellæ of *Fontana's* space are interposed between the main portion of the cavernous tissue and the iris. The cavernous tissue is perfectly normal. In some places the sheaths of endothelium are

detached from the columnæ, and between them we see plates of epithelium in manifold forms. The canalis Schlemmii has not the form of a fissure. In its place are three to four round, or elliptical small lumina.

No infiltration of the tissue forming the periphery of the chamber. Level of papilla normal. In the left eye the sinus of the chamber has a normal appearance throughout.

4. *Franz R.*, 44 years old ; died on April 12th, 1874.

Twenty-nine hours after death, I enucleated both eyes. The right showed no anomalies. In the left eye, out- and downward, about midway between centre and circumference of the cornea, was a very small corneal cicatrix, towards which the pupil was drawn. Having cut the bulbus in the equator and removed the vitreous and lens from the anterior half of the eye, I saw the iris normal with exception of the pupil. The latter had the form of a drop, the point of which stood off only a little farther from the centre of the cornea than would have corresponded to the place of the pupillary margin in the normal eye. The pupillary margin was entirely free, only a piece of the iris between its insertion and the free margin had entered the anterior synechia. In meridional sections a cup-like depression of the inner surface was observed corresponding to the corneal opacity, and at its margin Descemet's membrane was interrupted and filled with rarefied tissue of the iris. In many sections the defect of Descemet's membrane extended so far toward the circumference of the cornea that the distance between the (not dislocated) ciliary muscle and the boundaries of the defect of Descemet's membrane was only 2.310 mm. The piece of iris between these two points was nearly throughout attached to the ligamentum pectinatum, resp. Descemet's membrane. In some places the iris lay close to the anterior wall of the chamber beyond Descemet's membrane, then receded from it, and again approached Descemet's membrane 1 mm. from the anterior synechia and from there remained firmly adherent. The insertion of the iris was stretched, considerably thinned, in some places reduced to the uveal layer.

The cavernous tissue of *Fontana's* space was compressed, and sometimes its openings could not be seen at all. Schlemm's canal formed a very small split, or was made entirely invisible by compression. A good deal of pigment in granules and small heaps in *Fontana's* space, mostly accumulated near the posterior wall of Schlemm's canal. No infiltration of cells in any of the tissues forming the angle of the iris. Level of papilla normal. Very interesting indeed was the condition of the sinus of the chamber in sections made through parts of the anterior half of the bulbus, in which the iris had not entered the anterior synechia. In many sections the proportions of the sinus of the chamber were almost normal; but in most of them the sinus had shrunk by an elevation of the insertion of the iris, thus approaching the surface of the cornea, without, however, touching it. But the lateral wall of the chamber was adherent to the surface of the iris. The contents of *Fontana's* space had their normal size. The single columns with their nuclei were again distinctly visible. No pigment was found between them and the canalis. Schlemm's canal was normal in breadth, gaping and empty.

The optic nerve was normal.

The anatomical relations of the angle of the iris were perfectly normal in the right eye.

5. *Peter Linzerboth*, 66 years old, came to *v. Jaeger's* clinic on June 16th, 1876, on account of a total cicatricial staphyloma of the right cornea, which had the form of a cylinder. It had existed for two years, and prevented him from closing the lids. No signs of irritation. Tension glaucomatous.

On June 19th the globe was enucleated. The measurements immediately after the operation were: axis, from top of staphyloma to posterior pole, 28.5 to 28.8 mm.; elevation of staphyloma, 7-7½ mm.; base of staphyloma, resp. cornea, 11 mm.; diameter of the staphylomatous cylinder in the middle of its height, 11 mm.; transverse diameter of the eyeball, 22.5 mm.; vertical diameter, 22.2 mm. On December 8th, 1876, I found

the bulbus, which had up to that time been preserved in Müller's fluid, unchanged in form. The distance from top of staphyloma to posterior pole, 28.75 mm.; from posterior pole to posterior surface of lens, 17 mm.; thickness of lens, 3.75 mm.; distance from anterior surface of lens to top of inner wall of staphyloma, 6 mm.; wall of staphyloma, at its summit, 2 mm.; the diameter of the circle, inclosed by the ridges of the ciliary processes, 12 mm.

The lens was in its normal plane, notwithstanding the increased intraocular pressure which had produced a deep, total excavation of the optic disc. The zonula, in its free portion, was more tightly stretched and somewhat longer than normal. The iris everywhere joined closely the wall of the staphyloma, so as to form a part of it. The insertion of the iris was very much thinned, and attached all around to the ligamentum pectinatum and the membrana Descemetii. Towards the corneal centre the attachment extended 2.640-2.970 mm. beyond the margin of Descemet's membrane. Most firmly adherent were iris and ligamentum pectinatum. In this part almost only the uveal tissue of the iris remained. The cavernous tissue of Fontana's space was well preserved, but very much compressed. Considerable accumulation of pigment between the columns, especially around Schlemm's canal. The lumen of the latter was reduced to a small slit, in which, in some sections, I could see a few red blood-corpuscles. Where the iris had been separated from Descemet's membrane I could most distinctly see that there was no substance between them. Only in the connective tissue of the ciliary muscle, round cells in small quantity were found. The cavernous tissue between the margin of Descemet's membrane and the ciliary muscle was enormously stretched. The ligaments ran (in meridional sections) in a straight line toward the muscle. Also the meridional bundles of the ciliary muscle were noticeably stretched. The circular fibres were very scarce.

6. *Anna Z.*, 7 years of age. The left globe was enucleated on July 10th, 1875, on account of a corneal staphyloma, preventing the closure of the lids.

The measurements immediately after the operation showed: axis, from top of staphyloma to posterior pole, 31 mm.; horizontal and vertical diameters of the eyeball, each 23 mm.; the elevation of the staphyloma, 12 mm.; thus, the distance from the posterior pole to the base of the cornea, 19 mm. The staphyloma had a thin, transparent wall, presenting a vesicle filled with fluid. Upwards a margin of normal cornea, 3 mm. in breadth, remained; at all other sides the cornea was replaced by cicatricial tissue up to the scleral junction. The lens was in its normal plane. Corresponding to the preserved portion of the cornea, I found also the iris intact; but the central margin of this piece of iris was agglutinated to the border between cornea and cicatrix, which was marked by a deep depression, and in its whole breadth it was pressed against the cornea. Corresponding to the bulging cicatrix, the iris was reduced to single columns, which formed dark ridges on the inner wall of the staphyloma.

The iris, considerably attenuated, was everywhere adherent to the ligamentum pectinatum. On attempting to separate the connection, columns of the ligamentum pectinatum followed the iris, and even Descemet's membrane was separated from the cornea together with the iris. The cavernous tissue of Fontana's space was strongly compressed; the lumen of Schlemm's canal absent. Its position was marked by heaps of pigment. Only in the connective tissue of the ciliary muscle here and there round cells. Shallow physiological excavation.

I omit on purpose the description of further examinations of glaucomatous eyes, since they are not able to teach more than those alluded to. I have examined very many eyes with bulging corneal cicatrices, and in all of them found the sinus of the chamber obliterated in the above-described manner. My experience entitles me to suppose that these relations are found in corneal staphylomata without exception. I will not leave unmentioned that we must distinguish between the attachment of which I spoke before and the connection of the remaining iris and cicatrix after destruction of Descemet's membrane. This kind of attachment does not concern us here at all.

2.

The infiltration of the cavernous tissue of Fontana's space with red and white blood-corpuscles, with pigmented cells, pigment molecules, and heaps, I have observed in hemorrhage into the anterior chamber; in iritis without simultaneous disease of the corneo-sclera; in keratitis ulcerosa, where the iris participated in the inflammation to a variable extent, with or without collection of pus in the anterior chamber, before or after the perforation of the ulcer; in complicated inflammations of the anterior segments of the eyeball, with and without hypopyon, as they occur after injuries. An infiltration confined only to the tissue of the scleral channel (neighborhood of Schlemm's canal) or so predominating at this part that it could have been looked upon as the starting-point of the disease, I have never seen yet. I have also never observed that the infiltration of the tissue of the scleral channel had extended beyond it into the sclera. In stained meridional sections through the corneo-scleral margin of such eyes in which the cavernous tissue of Fontana's space is densely infiltrated, the strongly colored contents of the scleral channel contrast very nicely with the normal appearance of the sclerotic.

The cavernous tissue is sometimes so densely infiltrated that its spaces are entirely filled. The infiltration is most clearly seen in surface-preparations, made in the following manner: On a sector of the anterior half of the eye we separate the chorioidea-iris from the sclero-cornea. The columnar tissue, which, as long as the iris is in it, descends along the inner side of the ciliary muscle and loses itself partly in this, partly in the iris, remains in contact with the sclero-cornea, and appears as an elevation concentric with Descemet's membrane. If we take this up with a pair of forceps and draw it from its foundation toward the corneal centre, we find it connected with the ligamentum pectinatum and the tissue covering the scleral channel up to the margin of Descemet's membrane, and even with a portion of it. If we now put the object under the microscope with the side looking to the chamber placed upward, we

see the infiltration nicely ; but still better if with needles and forceps we split the preparation into single lamellæ. In some cases the infiltration assists in demonstrating the lamellar arrangement of the tissue between the margin of Descemet's membrane and the ciliary muscle. In meridional sections we can thus observe that between every two lamellæ a layer of pus and blood-corpuscles is interposed. The lamellæ themselves I have never found to be destroyed or even essentially changed. In surface-preparations I could see the nuclei of the epithelial sheaths covering the trabeculæ in a normal distribution, number, and size.

The canalis Schlemmii showed always some anomalies. Most rarely I found anomalies of its contents, as pus or blood globules isolated or even perfectly filling its lumen. Generally its form was changed, being narrowed in its whole length and even entirely obliterated, and the walls pressed together. I noticed that its two walls were not in the whole length approximated to touch each other, but only in some places, and that the canal was thus divided by isthmuses into two or more small lumina.

In none of the cases in which I saw Fontana's space infiltrated, the iris and ciliary body were in a normal condition, they always showed a similar infiltration. The sinus of the chamber sometimes contained blood, sometimes pus, in some cases it had no abnormal contents. The conformation of the sinus was sometimes normal, sometimes abnormal by conditions independent of the infiltration of its walls.

7. *Karl Tollich*, 66 years old, was admitted to *v. Jaeger's* clinic on August 26th, 1876, with iritis specifica o.d., and died on December 26th, 1876, of a left-sided pneumonia, rapidly terminating the life of the patient who was very much reduced by a chronic Bright's disease.

Tollich's eyes had been inflamed for two months before he came to the hospital, and when he entered he had no more signs of a recent inflammation. In both there were numerous posterior synechiæ and pupillary exudation ; the chambers had the normal depth. The acuteness of vision in the right eye was $\frac{2}{300}$, in the left only quantitative per-

ception of light. Tension in both changing, but never abnormally increased and mostly below the normal.

The microscopical examination of the anterior segment of the right eye showed: corneo-sclera perfectly normal; iris in its whole mass and extent densely infiltrated with pus-corpuscles, in the same manner the ciliary body. No abnormal contents in the anterior chamber; only in its extremest periphery, partly upon the ligamentum pectinatum, partly upon the anterior surface of the iris, lie some isolated pus-corpuscles. The cavernous tissue in the angle of the iris, from the iris to the margin of Descemet's membrane, and from Schlemm's canal to the ligamentum pectinatum, densely infiltrated with pus-cells. The canalis Schlemmii in some meridional sections narrowed and containing some pus-corpuscles, in other sections in two or three small apertures, in others again its lumen entirely abolished. The form of the sinus of the iris is almost everywhere normal; in some places, by swelling of its peripheral portion, the anterior surface of the iris has approached the cornea. A contact of the anterior and posterior walls of the chamber nowhere exists.

8. *Joseph Popowsky*, age 20 years, came to *v. Jaeger's* clinic on April 6th, 1875, on account of a keratitis pustulosa of both eyes, and died of tuberculosis on April 27th, 1875.

a. Left eye. In the upper half of the cornea, nearly reaching its margin, a sharply-defined elliptical ulcer, which measures in its longest diameter $5\frac{1}{2}$ mm. The bottom of the ulcer is very thin. The cornea around the ulcer thickly pervaded by pus-corpuscles. The sclera normal. The form of the sinus of the chamber normal. In meridional sections the cavities of the tissue in Fontana's space come out clearly. Within it a scanty purulent infiltration which disappears toward Schlemm's canal. The latter has mostly the form of a fissure, is gaping and empty. Only in relatively few sections the form of its lumen appears as much changed as in Case 7. Moderate infiltration with pus-cells in the tissue of the iris.

b. Right eye. In the inner superior quadrant of the cornea, an irregularly elliptic ulcer, 6 mm. long, one long side of which

coincides with the corneal margin. The bottom of the ulcer is formed by a prolapse of iris, which does not project over the level of the cornea. The perforation occurred eleven days before death. In the perforated space the iris consists of two layers, one ascending and one descending. Descemet's membrane adheres to the wall of the canal, and lying close to it and following all the folds of the iris, it ascends nearly to the level of the anterior surface of the cornea. Cornea and iris considerably infiltrated with pus-corpuscles; the vessels of the latter strongly filled. The cavernous tissue of Fontana's space is thickly set with pus-corpuscles. But even where the infiltration of the tissue of the scleral channel is most intense, the surrounding sclera itself shows no infiltration. In meridional sections the canalis Schlemmii cannot be recognized. In some places a layer of greenish coagula, to which a few pus-gobules adhere, is lying upon the iris. The iris is nowhere in contact with the cornea, even not in those parts of the periphery of the chamber which corresponds to the prolapse.

9. *Karl Zust*, 32 years old, boiler-maker, was injured on April 28th, 1874, by a small plate of metal which perforated the centre of the cornea, and remained in the lens. It was irregularly elliptic, 6.5 mm. long, 4.5 mm. broad, and about 0.2 mm. thick. On June 5th, when the patient came under treatment, there was moderate ciliary injection, the cornea transparent and shining, and had in its outer half an arched cicatrix with its concavity outwards. The chamber was shallow with a hyphæma $\frac{1}{4}$ " in height. The iris was discolored, and an intensely greenish-yellow reflex came from the fundus of the eye. The sight was lost. Tension far below normal, pain on touching very great.

On July 11th, this globe was enucleated for a sympathetic visual defect in the right eye. Then two-thirds of the chamber were filled with blood. The anatomical examination showed a very considerable irido-cyclitis with detachment of the retina. The piece of metal was lying a little behind the iris, imbedded in lens-matter and pus-cells. The point of interest here is that the anterior chamber as well as the cavities in the tissue, from the margin of Descemet's membrane to the ciliary muscle and in the

scleral channel were perfectly stuffed with white and red blood-corpuscles, especially red ones. I was very much surprised by the sharp limit between this alveolar tissue, pervaded by blood-discs, and the sclero-cornea, by the perfect conformity of the infiltrated mass with the contents of the anterior chamber, and by the simply passive condition of the tissue of Fontana's space, the cavernæ of which are so strongly infiltrated. The diameter of the whole mass of this tissue has naturally become much larger; this is recognized by a more complete narrowing toward the anterior chamber and by occlusion of Schlemm's canal. The lamellæ which are lost in the ciliary muscle appear radiating in meridional sections. (A very similar condition I have described in case 2, in which the hemorrhage had occurred after an iridectomy.) The sinus of the chamber was normal, the ciliary body being markedly drawn toward the axis of the eye. The ligamentum pectinatum was not attached to the corresponding portion of the posterior wall of the chamber.

(To be continued.)

SOME OBSERVATIONS AND REMARKS ON THE ACTION OF ESERIN IN GLAUCOMA.

By H. KNAPP.

SINCE the end of the year 1877, I have methodically used eserine in the majority of cases of glaucoma that have come under my notice. The results in some have been so striking that I wish to make known the experience hitherto gained, not as something definite, but as a modest contribution to the knowledge of the "antiglaucomatous" effect of eserine, discovered two years ago by Prof. LAQUEUR, of Strassburg.

Especially interesting are two patients, the one affected with acute glaucoma in one eye, the other in both. In the first, eserine was instilled from the second day of the disease, its action was prompt and complete, and the patient permanently cured. In the second case, the remedy was employed no sooner than two weeks after the onset of the glaucoma, its action was marked, yet relapses occurred, and iridectomy had to be resorted to. During the recovery, the first symptoms of glaucoma appeared in the fellow-eye. They were at once removed by eserine, but returned with increased intensity, yet were again removed by eserine. In a third and fourth relapse, the remedy produced only a remission of the symptoms. I was therefore obliged to perform iridectomy, by which the eye was permanently cured.

The following histories will supplement these comprehensive remarks.

CASE I.—H. M., a healthy Jewess of New York, æt. 35, came to my office Jan. 10th, 1878, with a small phlyctenular ulcer at the external corneal margin. Only three days previously, she had noticed the first traces of an eye trouble, and the small ulcer was without any complication. I ordered a half-per-cent solution of atropia to be dropped into the eye three times daily.

Four days later she returned, the ulcer was cured, the eyeball free from any irritation, sight perfect. For a low degree of swelling of the palpebral conjunctiva, I prescribed a weak solution of sulphate of zinc, telling her she should leave the former drops off, and need not come again, since her eye was cured.

On the 21st Jan., however, she returned with a severe attack of acute glaucoma in the same eye. The day before, her eye and its surroundings began to pain her, the ball was red, and sight cloudy. In the evening, she instilled one drop of the atropine solution which she had not used for six days. It increased the pain, though formerly it had no unpleasant effect whatever. She passed a sleepless night, having severe and constant pain in her eye and around it. Early in the morning, she came to me with the following symptoms: œdema of the lids, lachrymation, marked injection and some chemosis of the conjunctiva, cornea and pupil hazy, anterior chamber shallow, pupil somewhat more than middle-wide, immovable, background of eye veiled, disc and blood-vessels too indistinct to recognize pulsation, tension of the eye greatly increased, S. $\frac{15}{00}$, F. complete.

I told her that she had glaucoma, for which I would try a new remedy, but I would call on her in the afternoon, and, if her eye was no better, it should be operated on without further delay. I ordered a two-per-cent solution of sulphate of eserine to be instilled, one drop every hour; I further advised her to go to bed, take an aperient, put 6 leeches to the temple, and keep the after-bleeding up for one hour and a half.

When I saw her at 4 P.M., I found that she had strictly followed my orders, and the result was admirable. The pain had almost left her, the œdema of the lid and the swelling and injection of the conjunctiva had diminished, the cornea and iris were clear, the pupil was fully contracted, and, despite its narrowness, I obtained a clear view of the fundus. The papilla was well defined, arteries regular, not pulsating, veins dilated, remainder of fundus normal. The tension of the eyeball was normal, and even lower than that of the other (healthy) eye. The patient could count my fingers across two rooms, and read ordinary print by candle light. The inflammatory glaucomatous attack thus having completely subsided, I advised the patient to remain in bed, and instil the eserine drops every two or three hours.

When I saw her the next day, I found the œdema and redness further reduced, and the other conditions as favorable as the day

before. The improvement continued steadily. I ordered eserin to be instilled less frequently. On the seventh day her sight with — 2.5 D. was $\frac{3}{8}$. One drop of a fresh two-per-cent solution of eserin, which I dropped into her eye at my residence on the ninth day, made her eye red and gave her pain above the brow, lasting for two days. I advised her to remain in a moderately darkened room about a week, then gradually go out, but to continue the eserin for two to three weeks. Her recovery was undisturbed and complete. When I saw her June 15th, almost five months after the onset of the attack, her eye was normal in every respect, and she has used it without any inconvenience by day and by night.

CASE II.—C. L., Irish, healthy, æt. 37, was first seen by me at the beginning of February, 1878, after having had in her left eye pain, redness, and diminution of sight for two weeks. She presented a full picture of acute glaucoma. T. 2, circumcorneal injection, cornea dull, anterior chamber shallow; pupil wide, oval, and immovable, media turbid, fundus not visible, S. $\frac{1}{2}$, F. complete, ocular and circumorbital pain. She was ordered eserin every hour, rest in bed, six leeches to temple, and an aperient. The pain subsided at once; she passed a good night, and when I saw her the next day, the globe had normal tension, the pupil was narrow, though not so much as in a healthy eye, into which eserin has been dropped; the media had cleared up; the details of the fundus showed marked dilatation of the retinal veins, but no other abnormality. She was able to read moderately large print. I advised her to continue the use of the eserin drops, to stay at home, but not darken her room, as I thought that light might be favorable by assisting the myotic effect of the eserin. The attack disappeared, yet the pupil was never completely contracted.

A week later, the patient had another acute attack of the same intensity, which was treated and cured in the same manner.

Ten days after that, she had a third attack, to cure which she was admitted to the Ophthalmic and Aural Institute. Under the same treatment the symptoms abated, but the tension remained increased, and the optic disc began to be cupped. Then there appeared, in spite of the eserin treatment, a new increase of tension and an aggravation of the inflammatory symptoms. An iridectomy was performed without further deliberation. The operation was *lege artis* and clean, yet the restoration of the anterior chamber slow. The tension remained increased for several months, in spite of the continued use of eserin.

Four days after the operation, there was even a new attack of glaucoma. Pain considerable, circumcorneal injection, etc. Ordered five leeches to temple. Relief. Ultimate and lasting result moderately good. Tn., media clear, slight cupping of disc, F. somewhat contracted on nasal side, S. $\frac{3}{8}$.

Seven days after the operation on the left eye, the right eye, which before had been healthy, became painful, tension increased, pupil sluggish, sight dim. Ordered: leeches, eserine, aperient. The next day pupil fully contracted, sight and tension normal. Eserine left off four days after recovery from this attack. The following day, a new attack of glaucoma, which was cured in the same way. Four days later, obscuration again. Five leeches to the temple and eserine. Tension reduced, pupil contracted, but not so fully as before. Five days later, T. again increased, media turbid. Leeches were applied, eserine continued, iridectomy proposed, and performed the day after. Recovery prompt, complete, and lasting. At present, ten weeks after the operation, Tn., S. $\frac{3}{8}$, F. complete, anterior chamber of normal depth, media clear, no excavation, no atrophy of disc.

In another case, acute glaucoma set in in a previously healthy eye, seventeen days after the other had been operated on for chronic glaucoma, and had made a good recovery. Eserine applied to the eye suffering from acute glaucoma produced a temporary abatement of the symptoms, whereas a prompt and permanent cure was effected by an iridectomy. The history of the disease is as follows:

CASE III.—Julia H., a healthy Jewess of New York, æt. 49, consulted me March 23d, 1878. Her left eye had been weak since the end of August, 1877. At that time it was red and painful, and she saw haloes around the light. An oculist whom she consulted advised iridectomy, but she refused. The inflammation gradually subsided. When I saw her first, there was no irritation in that eye. The pupil was sluggish and larger than that of the other normal eye. S. $\frac{3}{8}$. Nasal half of F. wanting. T. 1, anterior chamber shallow. Optic disc deeply excavated. Iridectomy was performed March 23d, 1878, at the New York Ophthalmic and Aural Institute. The anterior chamber re-established gradually; the scar, raised at first, soon became firm; the iris, which, during the first two days was seen in the bulging inner corner of the wound,

retracted. When the patient was discharged, thirteen days after the operation, the anterior chamber was restored, the cicatrix flat, both sphincter edges of the coloboma were free; the tension was normal; the eye was free from irritation, and has remained so. June the 13th, 1878, almost three months after the operation, S. was $\frac{2}{8}$, and the field of vision somewhat larger than before.

Seventeen days after the operation, the patient presented herself again with the following condition of the other, right, eye: cornea hazy, pupil middle-wide, immovable, background veiled, T. 1. Colors around light; pain and circumcorneal injection, sight very dull, F. complete. The attack began four days previously, and had steadily increased in intensity. She was again admitted to the institute, treated with the ordinary two-per-cent solution of eserin every two hours, six leeches to the temple, and an aperient. The relief was immediate. The pupil contracted; the cornea and media cleared rapidly, and the tension became normal. Towards evening of the next day, despite the continued use of the eserin, pain and lachrymation set in again; the pupil became wider, and she saw rainbow colors around the light. As, on the day after, the symptoms had not abated, iridectomy was performed. The anterior chamber was restored on the fourth day; the patient was discharged cured a week after the operation. On June 13th, two months after the operation, her sight was $\frac{2}{8}$, Tn., F. complete

In *chronic glaucoma*, my experience with eserin has been larger. The results have been either negative or unfavorable. The application of eserin narrowed the pupil and reduced the tension more or less, but in several cases marked episcleral injection, lachrymation, and pain in the brow appeared during the instillations, and lasted for some days after the remedy had been left off. As an example, I may report the following:

CASE IV.—Rev. R. N., Christian, of New York; æt. 57, had a brother and sister both blind from glaucoma. He was operated by me for chronic glaucoma in both eyes, August 31st, 1876. Before the operation, S. was $\frac{2}{8}$ R., and $\frac{2}{8}$ L.; F.R. greatly contracted, L. complete. Operation and recovery good; S. remaining as before. He could see nicely, and had no inconvenience until November 21st, 1877, when a sudden blur came before the left eye, as the cause of which the OS. discovered numerous hemorrhages in the course of the dilated retinal

veins. S. $\frac{1}{100}$ in the right eye, S. $\frac{0}{100}$ L. I ordered him leeches and an aperient powder. The hemorrhages gradually absorbed, and on January 22d, 1878, his vision was $\frac{2}{10}$ again.

The right eye had from time to time been somewhat troublesome, and showed January 22d, T. 1; S. $\frac{1}{100}$. Since the left was restored to its *status quo ante*, I tried the effect of eserin on the right eye, one drop of a two-per-cent solution to be instilled every three hours. He had severe pain after the application of the remedy, which lasted all night, and was still present when he came to see me the next day. I found his pupil narrower than the day before, the tension about normal, but the episcleral veins were greatly enlarged and tortuous. This condition lasted for several days.

In no case of chronic or subacute glaucoma have I seen any benefit from eserin; on the contrary, it exaggerated some, as is exemplified by the following case, in which it positively did great harm in producing a severe attack of acute glaucoma.

CASE V.—E. St., a Jewess, of New York City, æt. 68, had had in her left eye glaucomatous symptoms for a year. When she came to the Dispensary, January 30th, 1878, that eye presented a shallow anterior chamber, opacity of the lens, excavation of the optic disc, S. $\frac{1}{100}$, no ascertainable limitation of the visual field, no marked symptoms of irritation, but somewhat increased tension. She was told that the eye had to be operated on. As she wanted to go home first, she was advised to use eserin, and return the next day. Her daughter came three days afterward, stating that her mother had used the drops, but her eye had become so red and painful, and she had felt such pains in her head, as to be unable to leave her bed. I told her to bring her mother to the institute, since only an operation could save her eye. When the patient came, on February 4th, five days after the application of eserin, she still showed the symptoms of an acute attack of glaucoma. She could only see the movements of the hand. F. was not to be ascertained, T. 1. An upward iridectomy was made, from which the eye did not recover. The anterior chamber was not restored for weeks, and the vision remained reduced to mere perception of light. The operation had been without accident, and the eye soon became free from irritation.

I have employed eserin also in a case of *absolute glaucoma*,

unfortunately without any benefit. The case briefly related is as follows :

CASE VI.—Edw. H., a Christian, of Bergen Point, New Jersey, æt. 67, admitted May 3d, 1878, lost his right eye some years ago. It was shrunken after repeated operative interference. The left has been blind for more than a year, showed cataract, intense ciliary irritation, and great increase of tension, no perception of light. The pain in the eye, its surroundings, and the head has, during the last months, been so great and constant, all remedies to relieve it having been exhausted, that he only asked to have this eye removed in order to get rest. Before complying with his request, I ordered leeches to the temple, and eserin to be dropped into the eye three to nine times daily. After this treatment had been continued four days without any relief, I removed the eye ; the patient lost all his pain, was contented and felt happy.

Preparatory to iridectomy, in order to operate under more favorable conditions, both as to tension of the globe and size of the pupil, I have often used calabar bean extract and sulphate of eserin, and though I fully appreciate its advantages, there seemed, in some cases, also a disadvantage to be inherent to the remedy ; that is, its tendency to produce congestion and inflammation of the iris. Of this I had an example quite recently.

CASE VII.—C. P. D., Christian, æt. 48, of Brooklyn, had in his left eye periodic obscurations of the visual field, chromatopsia, circumorbital neuralgia, and diminution of sight for four months. *Status præsens* on June 10th, 1878: T. 2, pupil wide, immovable ; sensibility of cornea reduced, anterior chamber very shallow, media clear. Moderate cupping of o. d. The most pronounced pulsation of the blood-vessels on the disc I ever saw. The arteries and veins pulsate simultaneously, and the pulse of both is synchronous with that of radial artery. Patient suffered from palpitation of the heart, and had a systolic murmur. F. contracted on nasal side, above and below ; S. $\frac{2}{3}$. I admitted him to the hospital, had leeches applied to the temple and eserin used. The next day the tension of the eyeball was reduced, but still exceeding the normal standard ; the pupil was narrow, the iris lus-

treless and apparently swollen, fine circumcorneal injection, and slight œdema, exhibiting the features of an acute iritis.

The upward iridectomy was made without accident, no instillations after it. The artificial pupil was clean, the lips of the wound applied well, yet the anterior chamber was not restored for several days, the finely striated circumcorneal injection persisted, and an anterior synechia with a short white horizontal streak in the cornea made its appearance on the lower inner border of the pupil. I ordered atropine instillations; the pupil dilated moderately, the anterior chamber became deeper, the irritative symptoms subsided, S. grew better, T. was normal, but on June 19th, when I saw him last, the synechia was still present.

In cases of *corneal fistula*, for which eserine is so much praised, I have seen only moderate benefit.

In one case, of several years' duration, the remedy had no effect. A large iridectomy closed the fistula, and the glaucomatous attacks thus far, three months, have not reappeared.

In another case, likewise of some years' standing, in which I had made an iridectomy without closing the fistula and without preventing the periodic glaucomatous attacks from returning, the remedy showed no other effect than to produce marked pain over the brow.

In a third case, in which the fistula had gradually been converted into a small staphyloma, I abscinded the protrusion, and since the wound showed a low tendency toward closure, I had eserine dropped into the eye three times daily. The remedy, in this case, was well borne, and seemed to accelerate the union of the small wound.

In a fourth case, I have no doubt that eserine did a great deal of good. It was that of a man whose left lens had been dislocated into the anterior chamber in consequence of an injury. Repeated irritation for years had been the consequence. The removal of the lens by a lower section was followed by escape of vitreous, which kept the wound gaping for a week, and there was slow progress in its closure. On instillations of eserine,

three times daily, the pupil became narrow, the wound united more rapidly, and was closed in ten days.

If I critically review the series of cases of glaucoma in which I have used eserin, and of which the above-described observations form the most striking examples, I essentially have to concur in the statements of *Laqueur* and *A. Weber* and others, though some opinions that have been advanced on the action and the use of eserin are not borne out by my experience. The sanguine hope with which the brilliant result in the first case of an acute glaucoma had inspired me soon vanished, and thus far I can only assert that eserin cures acute glaucoma permanently in exceptional cases; in the others it produces a temporary improvement, by which the patient may be beneficially prepared for the operation. In subacute glaucoma (case vii.), its effect is doubtful, and in chronic glaucoma, with or without subacute exacerbations, the remedy either has no effect at all, or is injurious (case v.). In corneal fistula and slow closure of corneal wounds from intruding vitreous, eserin may be of great assistance. Glaucoma supervening in the second eye during the recovery from an iridectomy of the first, was, in the cases that came under my care, not cured by eserin.

The tendency to produce iritis, which seems to accompany the myotic effect of the remedy in irritable eyes, and the fact that eserin may cause an acute attack in a case of chronic glaucoma, seem to warn us against the indiscriminate use of this powerful myotic. I shall unhesitatingly begin to treat cases of acute glaucoma with eserin, leeches, aperients, and anodynes, as we treat acute iritis with atropine, etc. If the pupil fully contracts and the attack is completely cured, an operation may, perhaps, never be necessary; but if the remedy produces incomplete myosis and incomplete reduction of the tension of the globe, or if relapses occur, iridectomy should not be delayed. In cases of subacute and chronic glaucoma, I shall resort to iridectomy at once. Preparatory to iridectomy, I would employ eserin only when the eyeball is extraordinarily hard, the pupil very wide, and the anterior chamber so

shallow as to render a smooth performance of the iridectomy difficult, or expose the eye to intraocular hemorrhage, in consequence of the sudden reduction of the high extravascular pressure. The prophylactic use of eserin in the healthy eye during the first time after a glaucoma operation on the other, which *Wecker* recommends, may be good practice. The cases reported above, in which eserin did not arrest the development of glaucoma in the other eye, are no evidence against *Wecker's* statement, since eserin was not used before the first symptoms of glaucoma had made their appearance.

A CASE OF SPONGY (FIBRINOUS) IRIDO-CHOROIDITIS, AFFECTING BOTH EYES AT AN INTERVAL OF SEVEN MONTHS.

By H. KNAPP.

IN my last paper on cataract extraction, I gave, at page 121, etc. (Vol. VI. of these ARCHIVES), a general sketch of that peculiar form of exudation into the anterior chamber and vitreous body, of which *H. Schmidt, Gunning, Gruening, and Kipp* have published some clinical observations, under the names of lens-like, gelatinous, or spongy exudation. Its nature is a fibrinous deposit, as Dr. A. Alt has shown by the microscopic examination of an extirpated eyeball (see the previous number of these ARCHIVES), and I by examining a specimen extracted from the anterior chamber after an operation—iridectomy—for glaucoma (see the paper mentioned above). The following case offers some new features which may be placed on record, since they may aid in drawing the clinical picture of this peculiar affection.

In May, 1877, a healthy-looking man of 27 years of age presented himself to me with a rather severe iritis, of ten days' duration, in his right eye. He had had gonorrhœa shortly before. As he did not live in the city, he was admitted for treatment to the N. Y. Ophthalmic and Aural Institute, where I had an opportunity of closely watching his case. The upper part of the pupil dilated soon after the application of leeches to the temple, instillation of atropine, the administration of an aperient, and keeping the patient in bed in a dark room. The lower part dilated incompletely, showed an irregular edge, but no marked excrescences. Two days after his admission, the lower half of the iris appeared duller than the upper, and the lower half of the pupil was occupied by a lattice-work of irregularly interwoven, partially delicate, and partially coarse, grayish fibres. The third day, the whole anterior

chamber was turbid, the whole iris dull, but the lower half more than the upper, and the lower half of the pupil was covered with a dense, spongy-looking, gray, somewhat yellowish mass. The fourth day, the whole anterior chamber was filled with a grayish, semi-transparent substance, which did not appear compact, but rather like a silk-worm cocoon. The irritative symptoms, which had been moderate at first, but increased daily, were now at their height. Œdema of lids and conjunctiva, some sero-mucous discharge, marked circumcorneal injection, not finely striated and light-red, as in acute simple iritis, but rather dark-red, the blood-vessels being dilated, tortuous, and reaching as far as the equator of the globe, circumorbital pain, increased in the night; sight reduced to the perception of the hand, tension normal, field of vision complete. On the fifth day, the irritative symptoms abated; the exudation in the anterior chamber had a more uniform, gelatinous aspect. From the sixth day, it began to contract and absorb. The exudation looked like a dislocated lens, the upper edge of which was sharp and well-defined, leaving a crescent of clear iris uncovered. Five days later, the whole mass was absorbed, the pupil free and widely dilated, the episcleral injection was reduced to a small zone around the cornea, the œdema of the lids and conjunctiva had disappeared.

The patient being able to count fingers at the distance of several feet only, I examined the interior of the eye with the ophthalmoscope, and found the whole vitreous diffusely opaque, the retinal veins dark-red, dilated, and tortuous; the arteries thin, difficult to be seen. In the lower part of the fundus was a grayish opacity, larger than the optic disk, covering the retinal vessels, its edges gradually fading away. From day to day, the interior of the eye cleared up, the gray patch was gradually but completely absorbed, and twenty-five days after the admission of the patient—that is, thirty-five after the beginning of the disease—the fundus was entirely clear, sight restored, yet there was still some congestion of the retinal veins.

For seven months the patient was completely well, using his eyes in reading and writing, from early in the morning till late in the evening, without any inconvenience.

Jan. 23d, 1878.—He again presented himself at the Ophthalmic Institution with a severe iritis, which had suddenly appeared in the other, left, eye, two days previously. The right eye was perfectly healthy. The same treatment was ordered.

Jan. 24th.—Pain; pupil wide and clear; extensive circumcorneal injection; œdema of upper lid; Tn.

Jan. 25th.—Anterior chamber turbid; in lower half of pupil a network of fine filaments, densest near the edge of the iris; severe pain; morphia at night.

Jan. 26th.—Extreme circumcorneal injection, chemosis, œdema of lids, severe pain; pupil wide and regularly round; the whole anterior chamber filled with a spongy, gray exudation; Tn.; sees movements of hand.

Jan. 27th.—*Status idem.*

Jan. 28th.—The spongy mass contracted, gelatinous, presenting a sharp margin at the upper circumference; less pain.

Jan. 30th.—The exudation sharply defined on all sides, incompletely filling the anterior chamber, resembling a semi-transparent lens, having a notch in its upper edge; irritative symptoms abating.

Feb. 1st.—Considerable pain during the night, photophobia, lachrymation; intense injection of globe; the whole anterior chamber dull and cloudy; Tn.; free from pain during the day.

Feb. 2d.—Less pain than during the previous night; anterior chamber cloudy, as before.

Feb. 3d.—The periphery of anterior chamber cleared up; oblique illumination shows a *second layer of whitish-gray exudation, covering like a watch-glass the previous lens-shaped exudation.* Its edges are sharp and notched in different places. No pain.

Feb. 5th.—Circumcorneal injection diminishing; both layers have almost disappeared, leaving only small remnants in the pupillary space. Fundus veiled by diffuse opacity of the vitreous.

Feb. 8th.—Injection less; fundus still cloudy.

Feb. 11th.—Vitreous clearer, but details of fundus still very indistinct; six leeches to the temple.

Feb. 14th.—Retinal veins recognizable, dark and tortuous; arteries hardly visible.

Feb. 19th.—Episcleral injection almost completely disappeared. Vessels of retina clearly seen. No trace of exudation in anterior chamber; pupil widely dilated by atropine; free from adhesions; Tn.; Fc.; no pain; patient discharged.

March 1st.—Interior clear; sclerotic white; atropine discontinued; no sequels of the disease left; S. $\frac{3}{8}$; duration of the inflammation, five weeks; recovery perfect.

June 15th.—Had no relapse ; both eyes normal.

The *novel features* of this case are :

1st. The occurrence of the same disease on the left eye without any apparent cause, after the right had been cured seven months.

2d. A second effusion of fibrinous exudation, when the first was in the way of absorption. I have recently seen this in another case. Though these conditions are by no means uncommon in other forms of iritis and choroiditis, I have not before observed them in spongy exudation, nor have they, if my memory serves me, been described by others.

In conclusion, I may mention that the severity of the inflammatory symptoms in the above case would have led me to frame an unfavorable, or, at least, doubtful prognosis, had I not recognized at an early stage the peculiar form of the exudation.

The binocular inspection with a large lens, by focal illumination, is a great help in seeing both the primary network of filaments and the spongy character of the fibrinous exudation, thus enabling us to make the diagnosis before the contraction and beginning absorption render the exudation lens-like or gelatinous.

ON PERIPHERAL DIVISION OF THE CAPSULE IN MORGAGNIAN CATARACT.

BY DR. EMIL GRUENING, OF NEW YORK.

In a paper published in the January and February number (1878) of the *Annales d'oculistique*, and entitled: "Sur les causes ordinaires d'insuccès dans l'extraction de la cataracte de Morgagni (cataracte à noyau flottant) et sur les moyens d'en triompher," Martin puts forth a number of propositions, which may be formulated synoptically as follows:

1. The delivery of Morgagnian cataracts is at times very easy, the contents of the capsular sac, fluid cortical substance and nucleus escaping after division of the capsule upon the slightest pressure; at times, however, altogether impossible, the fluid substance oozing out slowly and the nucleus remaining in the sac in spite of all expulsive efforts.

2. This diversity of results is not due to any inherent differential quality of the cataracts, but depends solely upon the *modus faciendi*, which, when the first result ensues, has been practised correctly but unconsciously by the surgeon.

3. The nucleus remains in the capsular sac, either because the opening made in the anterior capsule is too small to allow of its passing out, or because

4. The expulsive efforts are insufficient to accomplish the desired object.

In order to secure against the retention of the nucleus, and effect its easy passage in every case of Morgagnian cataract, Martin recommends the following operative steps:

- a.* Corneal section, Lebrun's upper median flap.

- b.* Iridectomy, if required.

- c.* Extensive horizontal division of the capsule in the largest diameter of the lens with v. Graefe's cystotome.

d. Expulsion of the contents of the capsular sac by depression of the upper lip of the corneal wound in the manner practised by Weber.

Martin lays particular stress upon the correct execution of the third step, *i. e.*, extensive horizontal division of the capsule in the largest diameter of the lens.

In the course of the last eight years, I had occasion to observe difficulties in the delivery of Morgagnian cataracts repeatedly, twice in my own operations, and several times in extractions performed by a skilled and renowned operator. In all these cases, the difficulties were finally overcome, and though I have never met with a case of Morgagnian cataract in which the extraction of the nucleus proved impossible, I can readily understand that such an adverse circumstance might occur. One of my friends, an oculist of established reputation, assured me that twice he had been obliged to leave the nucleus of a Morgagnian cataract in the eye.

In the month of October, 1877, a woman, having Morgagnian cataract in one eye, and immature cataract in the other, presented herself for operation. Mindful of the embarrassment occasioned me in the two instances alluded to above, and being aware that the ready expulsion of the cataract depended chiefly upon the proper direction, size, and locality of the capsular wound, I determined to deviate from the ordinary mode of performing the third step of the operation, *i. e.*, division of the capsule.

On the 25th of October, 1877, I extracted the Morgagnian cataract with the assistance of Drs. Born and Edward Fridenberg in the following manner :

a.) V. Graefe's peripheric linear section upward, with slight encroachment upon the transparent cornea.

b.) Broad iridectomy.

c.) *Division of capsule along the upper periphery of the lens by a rapid movement of a sharp v. Graefe's cystotome.*

d.) Gentle depression of the upper lip of the corneal wound with a broad metallic spoon and pressure upon the eyeball at

the lower portion of the cornea with the back of a hard rubber spoon.

The milky cortical substance, together with a nucleus somewhat longer than usual in Morgagnian cataract, rushed forth with great readiness. The wound healed nicely, and the patient was discharged ten days after the operation. Her ultimate vision was $\frac{3}{10}$, no secondary operation having been performed.

In comparing my method of opening the capsule in Morgagnian cataract with that proposed, but, as it appears from his paper, as yet not practised, by Martin, it is not my purpose to discuss the question as to whether v. Graefe's combined periphtric linear incision should be resorted to as a general method in preference to Lebrun's upper median flap-section, with or without iridectomy. I am of opinion that, in the operation for Morgagnian cataract, Lebrun's section is not admissible, because it renders peripheral cystotomy impossible, and consider v. Graefe's combined periphtric linear section highly commendable, as it prepares the way most efficiently for a successful peripheral incision of the capsule.

In ordinary cystotomy, especially when vertical incisions have been practised, the expulsive efforts force the nucleus into a periphtric capsular cul-de-sac, from which it cannot be dislodged with ease. Continued pressure avails nothing, as the nucleus is too small to execute the bascule-movement required for its engagement in a centrally located capsular wound.

The object of peripheral cystotomy in Morgagnian cataract is twofold: firstly, to abolish the periphtric capsular pouch which impedes the egress of the nucleus, and secondly, to evacuate the liquid cortical substance directly, without bringing it in contact with the iris. Martin desires to gain the same ends by rather inadequate measures. As he begins his operation with Lebrun's section, he is obliged to practise his horizontal cystotomy through the anterior pole of the lens. He thus forms a large upper capsular pouch, from which he endeavors to dislodge the nucleus by depression of both the upper corneal and capsular wounds.

In November, 1877, Knapp adopted peripheral division of the capsule in the extraction of cataract, and in a paper published on this subject in the sixth volume of these ARCHIVES records the results obtained in a series of twenty-nine cases thus operated upon by him, and recommends peripheral cystotomy as a general method.

OPHTHALMOLOGICAL REVIEW.

BY E. GRUENING AND H. KNAPP.

1. MAGNUS, H. Der Augenärztliche Stand in seiner geschichtlichen Entwicklung. (Reprint from the *Archives of the History of Medicine and Medical Geography*. Leipzig, 1878.)

2. KOENIGSHOEFER, OSCAR. On Jaborandi and Pilocarpine as Regards their Action upon the Eye. *Klin. Monatsbl. f. Augenhkde.*, June, 1878, p. 251.

3. WECKER, L. DE On the Comparative Use of Eserine, Atropine, and Duboisine. *Klin. Monatsbl. f. Augenhkde.*, May, 1878, p. 218, etc.

4. DEUTSCHMANN, R. Klinische und experimentelle Beiträge zur Resorption pathologischer Inhaltsmassen in der vorderen Augenkammer. *Graefe's Arch. f. Ophth.*, xxiv., P. II., p. 213, etc.

5. HOSCH, F. Zur Lehre von der Sehnerven-Kreuzung. *Klin. Monatsbl. f. Augenhkde.*, June, 1878, p. 281, etc.

6. SCHWEIGGER, A. TH. C. Ueber Glaucom. Volkmann's Collection of Clin. Lectures. Leipzig, 1877.

7. WECKER, L. DE. On Glaucoma. *Klin. Monatsbl.*, May, 1878, p. 189, etc., and *Annales d'Oculist.*, 1878.

8. SCHWEIGGER, PROF. Ueber sympathische Augenleiden. *Berl. Klin. Wochenschrift*, p. 281, May 20th, 1878.

9. MAUTHNER, L. Die sympathischen Augenleiden. (Lectures on Ophthalmology, I. Number. The Sympathetic Affections of the Eye.) Wiesbaden. J. F. Bergmann, 1878.

10. GRAEFE, ALFRED. Die antiseptische Wundbehandlung bei Cataract-Extractionen. (The Antiseptic Treatment in Cataract Extractions.) *Graefe's Arch.* xxiv., 1, p. 233, 1878.

11. HIRSCHBERG, J. Division of the Ciliary Nerves. *Berl. Klin. Wochenschrift*, p. 291, May 20th, 1878.

12. HIRSCHBERG, J. Zur Prognose der Glaucom-Operation. *Graefe's Arch.*, xxiv., 1, p. 161, 1878.

1. MAGNUS gives, in a paper of thirty pages, an interesting account of

the historical development of the *ophthalmological profession*. Thousands of years ago, the ophthalmology of the Egyptians enjoyed a high reputation through the world, as far as the world was civilized at that time. The practice of medicine was in the hand of the powerful priesthood. A patient did not send for a particular physician, but to a temple, and the priesthood selected for him the medical man whom they thought best qualified to treat his case. Thus the study of specialties was encouraged. The physician received no fee for his services, but was supported by the temple, to which patients when cured used to make gifts. The priest-physician was bound to treat his patient according to the rules prescribed in the sacred books, since the legislature believed that there were only a few men whose intelligence was so great as to improve on the modes of treatment laid down by the most skilful physicians.

In ancient Greece, essentially the same customs prevailed, and the temples of Diana were particularly celebrated for the cure of eye diseases.

In Roman history, especially during the Empire, we meet the ignorant traveling eye surgeon, who, by his vile practices, seemed to have monopolized ophthalmic art in such a way as to make its profession repugnant to respectable physicians. To prove this, the author states "that Galen had long hesitated in writing a treatise of scientific ophthalmology, in particular of its optical part, since he knew how distasteful such doctrines were to oculists." (*De Usu Part.*, lib. x., cap. 12.)

Throughout the middle ages the ophthalmic profession, both in its character and social standing, was degraded. The better oculists were mere imitators of the ancients, and whatever progress the history of ophthalmology has to record in these centuries, it owes to the labors of non-oculists; for instance, Salvini Amati (invention of spectacles), Alexander da Spina, Maurolycus, and others. The "traveling oculist" was a numerous tribe and a kind of outlaw among medical men, for Fabricius ab Aquapendente states that he had given up the performance of cataract operations, since he was afraid of the hatred and persecutions of oculists. On the other hand, their own lives were not safe. King John, of Bohemia, in 1337, had an oculist of extensive practice thrown into the river Oder, on account of his being unable to make his weak eyes strong.

Ophthalmology as a science begins with the eighteenth century, by the labors of Brisseau, Maitre-Jean, Boerhaave, Heister, St. Ives, Morgag-

ni, and others, and the *art of ophthalmology* assumed a more dignified aspect, though even such eminent men as Daviel, v. Wenzel, Assallini, Jung Stilling, and others still "traveled," yet they possessed great skill, high scientific attainments, and endeavored to hold up the honor of their profession. Still a worthier position eye-surgery gained in the beginning of the present century, by its admission into the regular plan of studies at the European high-schools. This advance movement was ushered in by the establishment of a chair and clinic of ophthalmology at the University of Vienna. That chair, from his first incumbent, the celebrated Beer, has always been occupied by excellent men. Other German universities followed the good example, and with men like Himly, Langenbeck, Jaeger, Walther, Chelius, Schmidt, etc., the traveling oculist, even of the type of the Englishman Taylor, could no longer compete. The development of ophthalmology in the last three decades is not spoken of in Magnus' paper. K.

2. At the close of a series of experiments instituted with a view of testing the action of jaborandi and pilocarpine upon the eye, K. sums up his results in the following propositions:

(1.) The spirituous and aqueous extracts of jaborandi, locally applied, have no effect upon the eye save a purely mechanical irritation of the conjunctiva. The active principle of jaborandi is obviously not contained in either of the extracts.

(2.) The internal administration of jaborandi causes moderate spasm of accommodation, approximation of the near point, coruscating scotoma, and a slight increase in the secretion of tears.

(3.) Muriate of pilocarpine, locally applied, causes *excessive* myosis and slight spasm of accommodation; subcutaneously injected, excessive spasm of accommodation, with approximation of the near point, *slight* myosis, and an increase in the lachrymal secretion. G.

3. WECKER sums up as follows:

The principal properties of *eserine* are:

(1.) Reduction of the tension of the eyeball.

(2.) Diminution of the conjunctival secretion, in consequence of contraction of the blood-vessels.

(3.) Reduced diapedesis in general.

The principal properties of *atropine* are:

(1.) Increase of the tension of the eyeball, in consequence of dilatation of the vessels, rising in certain cases (of reduced amplitude of filtration) to glaucomatous hardness.

(2.) Increase of the conjunctival secretion.

(3.) Crowding the iris-tissue into the iris-angle. This condition, in cases of perforation of the cornea, is apt to increase the impediments of filtration.

Duboisine is a new and powerful mydriaticum, derived from the Australian tree *Duboisia Myoporoides*, which belongs to the family of *Solanææ*. It may be employed in all cases that show a marked intolerance of atropia. Wecker states that he used it without producing the slightest irritation, in the case of a lady suffering from irido-choroiditis, who experienced intense conjunctival irritation after each instillation of atropine.

K.

4. D. investigated experimentally the absorption of pathological contents from the anterior chamber, and sums up his results as follows:

(1.) The iris participates most actively in the absorption of pathological contents from the anterior chamber.

(2.) Blood effused into the anterior chamber is absorbed in two ways. A portion of it remains fluid, penetrates unchanged into the iris, and is taken up immediately by the blood-vessels of this tissue, to be restored to the general circulation. The remainder coagulates, and undergoes in all its particles retrograde metamorphoses, fitting it for absorption. The red blood-corpuscles are destroyed after the liberation of their hemoglobine, either before or after they have been incorporated in wandering cells from the iris and the ligamentum pectinatum. The coloring matter set free is collected into granules and crystals which are found uncombined in the iris. Further changes were not observed.

(3.) The mode of absorption of a hypopyon could not be determined directly by experiment. In analogy with the fate of granular pigments and blood injected into the anterior chamber, it seems probable that its elements undergo the same changes and are removed in the same way as the coagulated portion of the hyphæma (with the exclusion of the red blood-globules).

(4.) Sulphate of eserine accelerates the absorption of pathological effusions from the anterior chamber by extending the absorbing surface of the iris to its greatest natural limit.

(5.) The effect of atropine is the direct opposite to that of eserine, as it contracts the absorbing surface.

(6.) Eserine is therefore useful and to be recommended in pathological effusions into the anterior chamber, especially in circumscribed purulent infiltrations and penetrating ulcers of the cornea with hypo-

pyon. It exerts no beneficial action where an iritic complication can be diagnosticated clinically, as is often the case in *ulcus corneæ serpens*. Here even the greatest extension of the absorbing surface is rendered useless by the inflammatory infiltration of the iris.

(7.) In view of the rôle played by the iris in absorption, the performance of a downward iridectomy seems to be counter-indicated whenever hemorrhage is feared. G.

5. H. reports the history and autopsy of an interesting case bearing on the question of complete or semi-decussation of the optic-nerve fibres in the chiasm. He believes that the solution of this question is reserved to clinical observations and pathological anatomy.

The patient, a man aged fifty-four, had had a slight apoplectic attack in March, 1875, following which the left side of the body remained weak, and the left half of the visual field was lost in either eye. In December, 1875, a second attack occurred, severer than the first. Patient soon recovered, the defect of the visual field remaining.

In February, 1876, H. saw the patient, and found O. D. with direct fixation S. $\frac{1}{2}$, H. $\frac{1}{3}$; O. S.—S. $\frac{1}{2}$, H. $\frac{1}{3}$.

Left half of each visual field completely devoid of sensibility. On both sides the line of division is just outside of the point of fixation (and thus we can understand why with direct fixation S. is almost normal). In the fundus some striped retinal hemorrhages; both discs somewhat red with ill-defined borders.

A third apoplectic attack in April, 1877, produced a total paralysis of the left side, and was followed by frequent epileptiform seizures, probably due to small hemorrhages. The patient took to his bed, and in December his mental condition was such as to render an examination very unsatisfactory. Still some words in small print could be read when they were held somewhat to the right.

On the 22d of January, 1876, a severe apoplectic attack paralyzed the right side of the body completely, the patient dying two days later.

Autopsy (of brain only).

Extensive atheroma of all arteries down to their finest ramifications; on the convexity, multiple miliary aneurisms; immediately behind the chiasm a recent blood-clot, lying on the right optic tract, compressing it and the right side of the tuber cinereum.

On the *right side*, behind the optic thalamus and extending into the inferior cornu, a large cavity, which has destroyed the greater portion of the occipital lobe.

In the vicinity of the corpus striatum, a large pigmented cicatrix, involving the optic thalamus; corpus striatum and lenticular nucleus markedly diminished in size; in the scar a cyst as large as a pea.

On the *left side* of the convexity, a small extravasation; in the white substance of the parietal lobe, a brown cicatrix, the size of a pea. In the region of the third ventricle, the base of which is perforated near the infundibulum, a large recent effusion of blood, the brain-substance very much lacerated.

The optic nerve apparently quite normal, with the exception of the slight impression on the right tract mentioned above. On repeated measurement, the right tract proved to be the narrower and the right nerve the thinner of the two, though but slightly so.

Vertical sections of the chiasm, seen through the microscope, showed a large number of "corpora amylacea" under the covering of pia mater. These, according to Leber, are pathognomonic of atrophy. Whether one side of the chiasm was more affected than the other could not be determined.

Transverse sections of both optic nerves showed unmistakable atrophy of the *inner* fasciculi with numerous corpora amylacea. $1\frac{1}{2}$ -2 cm. in front of the chiasm, the sections showed the normal appearance of the optic nerve.

H. argues that, as all old foci (of any extent) were found on the *right* side, in the region of the right optic centre, they alone could be the cause of a hemianopsia of three years' standing. If, with the destruction of the right optic tract, the left eye had become entirely blind, we would assume that complete decussation of the nerve-fibres in the chiasm obtained.

Here, however, all the fibres going to the right halves of the retinæ were paralyzed, and left hemianopsia ensued.

H., therefore, is decidedly in favor of the theory of semi-decussation (as set forth by Gudden). G.

6. SCHWEIGGER states that the inflammatory symptoms in glaucoma do not depend upon the *degree*, but upon the *rapidity* of the increase of intraocular pressure. Smoky opacity of the cornea is the first symptom, opacity of the media is doubtful, that of the vitreous he has never seen. Enlargement of the pupil is produced by a rapidly increased tension; a slow increase may reach even a higher degree without paralyzing the ciliary nerves, or enlarging the pupil. If, in a case of glaucoma, the pupil is large, we may infer, even if no inflammatory symptoms are

present at the time, that formerly there was a rapid increase of tension. He says that the word atrophic excavation should be discarded, since the bottom of an atrophic optic nerve is still situated at the level of the choroid. The extent of a physiological excavation, as well as the degree of intraocular tension, has a large range surpassing the beginning of the pathological condition. An excavation may be partial, and, nevertheless, glaucomatous in a given person, or, on the other hand, total or almost total, and still be healthy. In such cases, the comparison of one eye with the other will frequently assist us. If S. and F. are normal, the excavation is physiological. If there is a physiological excavation combined with incomplete atrophy of the optic nerve, the limitation of F. will begin on the temporal side, and the perception of colors is deficient, whereas in a glaucomatous excavation connected with atrophy of the optic nerve, the limitation of F. begins on the nasal side, and the perception of colors is good. Sch. cites MAUTHNER, who observed that repeated glaucomatous attacks may lead to atrophy of the disc without cupping, and he adds that in cases of marked hardness of the globe, progressive atrophy and amblyopia without cupping may be arrested by iridectomy. In cases of complete or extensive circular synechia, iridectomy should be made in order to prevent secondary glaucoma, from the same reason a prolapse of iris that does not heal with a smooth scar, but becomes ectatic, should be removed. Glaucoma hæmorrhagicum is, in the great majority of cases, not cured by an operation. Sclerotomy has cured a number of cases, whether in the same percentage as iridectomy or not, is yet unknown. The efficacy of a glaucoma operation does not result from the establishment of a "filtration scar," for Sch. has seen eyes with a cystoid scar after iridectomy get blind by a relapse of glaucoma. He has seen no benefit from eserine in chronic glaucoma, whereas in acute attacks this remedy did good, without preventing relapses. Sch. is an advocate of iridectomy. The theories on the nature of glaucoma which GRAEFE advanced twenty years ago, have been replaced by others, which, in their turn, will perhaps share an equal fate. The fact which Graefe discovered, that glaucoma is curable by an operation, will last. K.

7. WECKER, in accordance with KNIES and WEBER, believes that glaucoma is produced by impeded filtration, on account of obliteration of Fontana's spaces. Glaucoma constitutes about one per cent of the eye diseases that have come under his care. He militates against Donders' theory of hypersecretion, in consequence of irritation of the

fifth pair in eyes not predisposed to glaucoma, though he admits that in "*reduced amplitude of filtration*," periorbital neuralgia, moral excitement, and similar conditions may occasion a glaucomatous attack.

He advocates *sclerotomy* in glaucoma, though in cases involving great responsibility, he does not like to depart from the iridectomy of Von Graefe, whose excellent results have stood the test of time. In sclerotomy he uses sclerotomes of different width, from 2 to 4 mm., the ends of which are lance-shaped. He makes a section in the corneo-scleral juncture, 1 mm. behind the transparent margin of the cornea, the basis of which lies about midway between the horizontal meridian and the upper or lower edge of the cornea. At the apex of the section he leaves a small part of the limbus undivided, but so that Fontana's space is opened along the entire section. Before the operation and for some days after it, sulphate of eserine is instilled. "In general, it is no longer permitted to perform any operation for glaucoma without previously subjecting the patient to the action of eserine; but we should know that in acute glaucoma the effect of the myoticum is but very incomplete." K.

8. SCHWEIGER states: When in an eye, affected with irido-cyclitis or irido-choroiditis, not the whole ciliary region is painful on pressure, it is always the upper part, if any, that shows this symptom. Such an eye, if more or less atrophic, may always be suspected of becoming the cause of sympathetic affection in its fellow, and its removal is justifiable, though we should bear in mind that atrophic eyes may for years be painful in the ciliary region without ever producing any sympathetic symptoms, and not all affections that may, under these conditions, occur in the other eye, are of a sympathetic nature. He speaks favorably of the division of the ciliary nerves to prevent sympathetic ophthalmia. He has done it repeatedly. The operation has been complete, *i. e.*, all the nerves may be considered as divided, if the cornea is found insensible, and the ciliary region, when pressed upon, free from pain. J. C. Vignaoux (*Affections sympathiques de l'œil*, Paris, 1877) divided the ciliary nerves and the optic nerve with curved scissors, by burrowing under the conjunctiva between superior and internal recti, and thus reaching the nerves, without myotomy. K.

9. MAUTHNER places before us the first number of a series of clinical lectures on all subjects of ophthalmology, which he intends to treat in the manner of Volkmann's and Seguin's clinical lectures. They will be exhaustive, so that the specialist may read them with advantage, yet so

elementary that the student of medicine and general practitioner can understand them. The specimen number before us treats of the etiology and pathology of the sympathetic affections of the eye. An anatomical sketch of the ciliary body, iris, the cavities adjacent to the iris, and the ciliary nerves introduces the student in a very happy way into the pathology of this region, which prevalently is the seat of the sympathetic diseases. He first speaks of the numerous affections which have been seen or supposed to produce sympathetic ophthalmia in the fellow-eye. Though the descriptions are chiefly original, drawn from the writer's personal experience, he gives an extensive critical review of the literature on the subject. In vain, we are sorry to say, we looked for the name of *McKenzie*, the first author on sympathetic ophthalmia.

The first part of the paper, pp. 1 to 32, gives a very clear and full picture of the etiology of sympathetic ophthalmia, but does not seem to contain anything essentially new. The second part, pp. 33 to 58, describes in detail all the symptoms of sympathetic ophthalmia. The beginning of the *sympathetic irritation* M. is inclined to place into the retina, since photophobia, photopsia, asthenopia, periodic obscurations of the visual field, anæsthesia of the retina with concentric limitation of F. (stenopsia without physical changes, Schilling), are its prevalent symptoms, and frequently precede ciliary neuralgia and blepharospasm.

Among the symptoms of *sympathetic irritation* he mentions: *Keratitis*, superficial vascular, with intense conjunctivitis, periorbital pain, and headache, described by Warlomont. *Intermittent Keratitis* (Rossander). *Irido-Keratitis* (Galezowski, Vignaux, and others). The *inflammation of the uveal tract* is of the greatest importance. Its forms are: *iritis serosa*, prognosis good; *iritis plastica*, prognosis unfavorable; *iritis maligna*, *i. e.*, irido-cyclitis plastica, prognosis very bad; by extension of the process *uvéitis totalis*, *i. e.*, irido-cyclo-choroiditis, the worst of all.

As a remarkable symptom of sympathetic irido-cyclitis, M. mentions the following: If only one point of the ciliary region of the eye primarily affected is painful or more painful than the others, the corresponding point only in the eye sympathetically affected will likewise be painful, or more so than the other points.

Sympathetic choroiditis and retinitis, first described by von Graefe, then by Pooley, Galezowski, Rossander, and others, may be either a complication of iritis and cyclitis, or independent of them. The occurrence of sympathetic glaucoma is denied. Some modern operations,

linear extraction, irido-desis, and the drainage of the eye (de Wecker), have been the cause of sympathetic ophthalmia.

If the following numbers of these lectures do not fall short of the first—and we do not see why they should—, we may safely predict for them a good deal of popularity, for they are nicely gotten up, and their style is easy, animated, and entertaining—somewhat in the manner of modern magazine literature. They are sure to afford, both to the specialist and the progressive general practitioner, enjoyment as well as information.

K.

10. *Alfred Graefe*, among other preliminary remarks, says (p. 235): If antiseptic treatment has the virtue of obviating in a wound not only the fatal *decomposition* of pus, but also its *formation*, we must infer that the formation of pus is occasioned by exotic germs, and consequently the first act of septic disease. He adds, however (note on page 236), that the question whether, besides the septic, we have to admit an aseptic suppuration or not, is not yet settled. A full introduction of Lister's method into eye surgery seems impracticable. After many experiments, the author has tried, without modification, the following plan on 114 extractions. All complications that may contain septic substances, for instance, lachrymal and conjunctival diseases, are first removed as much as possible. The day before the operation, one drop of a one-per-cent solution of atropia is instilled, and shortly before the operation the conjunctival sack is gently swabbed with a two-per-cent solution of carbolic acid. At the same time the lids and the whole orbital region are cleansed in like manner, and a sponge, moistened with the same liquid, is applied to the closed eyelids until the operation begins. Before and after each operation, the instruments are steeped in absolute alcohol, and wiped with clean soft linen. All cleansing during the operation is done with sponges dipped in a two-per-cent solution of carbolic acid, to replace the spray which Gr. thinks too troublesome and exciting for the patient. Atropine is instilled once or twice during the cleansing of the eye, which is done most carefully. The moment the sponge is taken away, a piece of borated lint is placed upon the eye and the whole orbital region, immediately saturated with a four-per-cent solution of boric acid, and covered, beyond its edges, with a piece of finest oil-silk which, immediately before, was also drawn through a solution of boric acid. Then the orbital region is padded with wound wadding, held in position by a bandage of fine elastic flannel.

The dressing is changed every twenty-four hours, except when unu-

sual irritation follows. In this case the eye remains covered only with a piece of carbolized lint, and cold applications are applied for twenty to thirty minutes, during which time a four-per-cent solution of carbolic acid is brushed upon the lint. As soon as the dressing is removed, the sponge, saturated with a solution of boric acid, is placed upon the eyelids, and with it all cleansing is done, without opening the palpebral fissure. Then the antiseptic dressing is applied as before. In this way the eye for a week is as little as possible exposed to the action of septic germs that may be suspended in the air. Atropine is instilled from the third day after the operation.

The author mostly practises the lower section, steadying the globe by Pamard's pique, and, before the expulsion of the lens, removes both the lid-holders and the pique, in order to close the lids immediately after the exit of the cataract. He takes great care to avoid incarceration of the iris in the wound by pushing the iris back with a blunt probe.

The results of the 114 extractions have been very favorable, more favorable than those of previous operations. There was suppuration of the wound in three cases, two of which were totally lost, the third ended in chronic iritis with periodic hypopyon, and was discharged with about $\frac{3}{8}$ of an inch. A fourth case, extraction within the unopened capsule with some loss of vitreous, ended in phthisis bulbi from chronic cyclo-hyalitis. Three other cases showed iritis with more or less dense pupillary membranes, and little satisfactory visual results.

The reviewer, on a visit to Halle, was authorized by the writer to add to his report that the recent results of extractions performed and treated in the same manner, have been less favorable than before, showing an inordinate number of disastrous suppurative processes. K.

11. *Hirschberg*, in the discussion of a paper by *Dr. Schöler* on enucleatio bulbi, in the Berlin Medical Society, gives a historical sketch of the operation of dividing the ciliary nerves. It was proposed by *A. von Graefe* in 1866, and executed by *Ed. Meyer*, first in the same year, and frequently afterward, then by *Secondi* and *Lawrence*, both in 1868. The division of the optic nerve for very annoying photopsia and chromatopsia was done by *A. von Graefe* in 1867, and, together with the division of ciliary nerves by *Landesberg*, in 1869. *Landesberg's* method (described in vol. XV. of *Graefe's Arch.*) of first dividing the tendon of the internal rectus has been that followed by *Schöler* and *Schweigger*. *H.* thinks that neurotomy for sympathetic affection is indicated in a few

cases only. We have to rely on the enucleation of the globe which he has performed about 150 times without ever seeing it followed by unpleasant consequences.

K.

12. *Hirschberg* compiles seventy-seven glaucoma operations from his own practice during the last four years and a half. He followed von Graefe's rules, with a few exceptions, in which he performed sclerotomy according to Wecker. The results on the whole agree well with those published by von Graefe. He gives a tabulary statement of all the cases, so as to enable the reader to draw his own conclusions. Among the seventy-seven eyes there were :

A. *Four of absolute acute inflammatory, primary glaucoma.* One, showing no inconvenience, was left alone ; in the second the pain was removed by puncture of the cornea ; the other two required enucleation. If the fellow-eye is healthy, H. does not venture to perform iridectomy in absolute glaucoma, on account of the danger of inducing glaucoma in the healthy eye. Within twenty-four hours after sclerotomy also, he has noticed the occurrence of glaucoma in the fellow-eye. *Eighteen eyes with acute inflammatory glaucoma.* Seventeen yielded a good result, one was a failure, the patient being unruly, the section went into the cornea, and incarceration of iris took place.

B. *Two eyes with absolute chronic inflammatory glaucoma ;* in one nothing was required, in the other iridectomy was made in both eyes ; since the fellow-eye also suffered from glaucoma. The glaucomatous inflammation was removed.

Ten eyes with chronic inflammatory glaucoma ; in nine iridectomy yielded a permanently satisfactory result, in one a second operation had to be made two years later, vision poor, $\frac{6}{60}$, but stationary (4 yrs.).

C. *Simple primary glaucoma* subdivided as follows :

a) *Thirteen eyes* with Sc. $\geq \frac{1}{10}$, and F. at least 10° beyond point of fixation. In ten eyes the glaucoma was arrested, in one S. was gradually abolished, in two, the satisfactory result lasted only a year.

b) S. moderate, limit of F. reaching point of fixation.

One eye with gl. simpl. myopicum. Iridectomy, result unfavorable.

c) Sc. and Se. considerably reduced, F. greatly contracted.

Nine eyes ; in four iridectomy with a permanently satisfactory result ; in three eyes the primary result was satisfactory, but the time of observation was too short to judge of its duration ; in two cases, failure.

d) Glaucoma simplex absolutum, including those cases in which S. $\frac{1}{2}$, existed for months.

Three eyes; in two the operation preserved S. $\frac{1}{2}$, in one a double iridectomy had to be followed by enucleation, on account of pain.

D. Of seven eyes with *glaucoma hæmorrhagicum*, only one yielded a satisfactory result.

E. Of eight eyes with *secondary glaucoma*, four in the absolute (confirmed) stage were beyond hope; of the others, three retained their small remnant of S., and the last lost it gradually. κ.



OTOLOGICAL PART.

SUPPURATIVE OTITIS MEDIA—CARIES OF MASTOID—EROSION OF VEINS AT BASE OF SKULL.—EMBOLIC ABSCESES OF LUNGS.—PNEUMOTHORAX RIGHT.—DEATH.—AUTOPSY.

BY DR. CORNELIUS WILLIAMS,

Assistant Surgeon at N. Y. Ophthalmic and Aural Institute, Attending Surgeon Outdoor Department Mt. Sinai Hospital, Attending Physician to Northern Dispensary, etc.

DURING the latter part of December, 1877, Willie Hübner, about six years old, came to Dr. Knapp at the New York Ophthalmic and Aural Infirmary on account of discharge from left ear, and giving the following history. He had suffered for several years from purulent discharge from left ear, with occasional intermissions, when he was free from any sign of the disease. On one occasion, there had been swelling with great pain and tenderness behind the ear, for which an incision had been made by a surgeon.

The present attack began about three weeks ago, with pain in the ear, fever, and was followed by discharge of matter from external meatus. An examination disclosed a fluctuating swelling behind the ear which was opened, and about three drachms of thick pus set free. It was then found that a probe could be passed into a cavity within the mastoid and toward the middle ear for eight or ten lines. The membrana tympani was perforated. The patient was then referred to me for further treatment.

The ear was cleansed, as was the abscess cavity, and a tent placed in the latter. Instructions were given to the mother as to the care necessary, and to return again in a couple of days. Sulpho-carbolate of zinc, gr. v.; Alcohol, 3 i.; Glycerine and water, $\text{aa.} \frac{1}{3}$ i. was ordered. To put three drops in the ear three times a day.

The patient was brought back in about a week. The discharge from

the ear and from the opening in the mastoid was less, he had had chills followed by sweating. Temp., 102; pulse, 100. Ord. quin., to make warm applications to side of head, and to remain in bed. Jan 5th, 1878, patient has had more chills, but less severe. Temp., 101; pulse, 96; complains of pain in side, and respirations are increased. Auscultation does not enable me to detect any change from normal in chest.

Hyposulphite of soda was ordered gr. vi. every three hours, to have nourishing liquid food, together with a modicum of brandy. Jan. 6th, symptoms same, continue treatment. Jan. 7th, there is no discharge from ear or mastoid; parts dry, hot; distinct râles can be heard over various parts of chest. Respirations, thirty per minute and shallow; tem., 100½; pulse, 110. Jan. 8th and 9th, no increase in severity of disease, treatment same.

Jan. 10th. Respirations, sixty per minute; light moist râles heard all over chest, except right infra-axillary region, where there is tympanitis, metallic tinkle, and amphoric breathing over a space as large as the hand.

Percussion note elsewhere duller than normal, with signs of solidified lung, at base posteriorly and left. Child perfectly conscious, with no sign of meningeal implication. Temp., 100; pulse, 130. Treatment same, with addition of ¼ gr. digitalin three times a day.

January 11th.—Area of tympanitic resonance now includes nearly the whole of right chest; other physical signs more pronounced. The ear and the opening in mastoid have remained dry; warm applications have, from time to time, been made to that side of head, and the abscess cavity and external ear carefully syringed. Temp., 100½; pulse, 130-140; respirations, 70 per minute.

January 12th.—Patient died about 6 A.M.

Post-mortem examination, 9 hours after death, assisted by Dr. B. Bettman. Rigor mortis well marked; body but little emaciated; calvarium easily removed; no fluid in the arachnoid, subarachnoid, or ventricular spaces; a sero-sanguinolent fluid welled up at base of brain as the tentorium was detached and cut through; no necrosis of the dura mater or of any part of the inner table of the temporal bone. Because of this and hurry, the sinuses were not carefully examined. Subsequent examination of the piece of the temporal bone sawn out and carried away showed the mastoid portion and cavity of the middle ear

to have been converted into a common space, which was filled with a semi-solid caseous mass. This cavity extended anteriorly, and communicated directly with two small veins which emptied into the internal maxillary vein. A bristle or small probe could be made to pass without any force from the external ear or through the opening in the mastoid and made to emerge at the cut end of the internal maxillary, between the temporal and pterygoid muscles. No thrombus of this vein could be discovered. Sections of the brain were made in every direction, without anything abnormal being found.

The lungs were found to be studded with a vast number of small abscesses, ranging in size from a grain of wheat to a hazlenut. Each abscess was surrounded by a zone of solidified lung-tissue, which was not essentially thicker at one part than another.

The pus of the abscesses was thick and creamy, in some cases partly inspissated. There were, perhaps, three times as many in the right lung as in the left, and here some of them were found to have penetrated the pulmonary pleura. The right lung was compressed into a flattened cake, which sank when placed in water. The right pleural space was filled with air and about six fluid ounces of a soft, very white, jelly-like mass of albuminous or fibrinous exudation. In some places a beginning organization was found. It contained no pus or purulent fluid.

The heart, liver, and kidneys were normal; other viscera not examined.

A few remarks on the above case may not be out of place. The literature of purulent inflammation of the middle ear for the last fifty years would go to prove that, in those cases having a lethal ending, the fatal result is brought about generally by extension of the morbid processes to the brain, either through the mastoid or through the tegmen tympani, abscess of the brain, meningitis, or phlebitis, with succeeding pyæmia from purulent disorganization of the thrombus being the outcome.

A perusal of the record of the cases published, however, will

show that the actual cause of death in very many cases is a matter of uncertainty.

It is assumed that there has been pyæmia when some of its symptoms have been noted, and the patient dies, no post-mortem examination having been obtained. But many of the signs of pyæmia may be present, or rather signs common to pyæmia and other conditions, without there having been really pyæmia in the strict sense of the word.

In this case I think it fair to assume that death was produced by the very extensive implication of the pulmonary tissue by the abscesses and the consequent pneumonia and pneumothorax. It is also more probable that these abscesses were produced by a great number of minute emboli carried into the circulation from the small veins, inflamed by proximity to the carious bone, and before their coats were eroded and actually perforated. None of these emboli were small enough to filter through the pulmonary capillaries, and were all arrested there, producing a circumscribed abscess by mechanical irritation, through inflammation of the walls of the capillaries themselves, the same as would a minute globule of mercury cast into that system from the right heart.

ON THE OPERATIVE TREATMENT OF SUPPURATION OF THE EAR.

BY DR. OSCAR WOLF, FRANKFORT-ON-THE-MAINE.

Translated by JAMES A. SPALDING, M.D., Portland, Me.

(With two woodcuts.)

II.

As, in the first part of this paper (ARCHIVES, vol v., p. 94, etc.) I discussed the causes of those otorrhœas which resisted all methods of treatment hitherto used, and then pointed out that the seat of the suppuration, at more or less deeply lying and hidden parts of the acoustic apparatus, depended upon processes of adhesion or granulating growths, with or without necrosis or caries of the underlying bony parts, in order then to recommend to my fellow-practitioners the operative treatment by means of the scar-loosener, or sharp spoon therein described; so now I am saved the trouble of proving in the following pages in detail that the method described is easy and safe to practise; that, in a series of cases since the time of the first publication, it has proved itself of benefit, as well by an improvement of the hearing, as through removal of the disagreeable and oftentimes dangerous discharge, as well as of the attacks of dizziness due to the pressure of exuberant granulations, and of the subjective noises, and that the suspicions expressed by a critic, as regards eventual damage of the sound-conducting apparatus, either physiologically or acoustically, are ungrounded.

Since I have had opportunity of watching a majority of the cases in question for a long period, and often through many years, I may be allowed some judgment as regards the frequency and form of possible relapses, and as to the final healing of the formerly carious bony parts.

Following the anatomical arrangement of the parts, I begin with those otorrhœas which have their seat in the external auditory meatus.

As mentioned (l. c.), I found as a frequent cause of the formation of granulations in the external auditory meatus, deeply burrowing furuncles, chiefly at the edge of the bony portion, in which (owing to the great pressure, and extremely trifling yielding of the cuticular lining of the auditory meatus, probably also with the destruction of the subcutaneous connective tissue) the periosteum is also destroyed, whereupon, as a result of disturbances of nutrition, small, circumscribed particles of bone necrose, and they, overgrown with granulations, in their turn keep the whole region in a chronic inflammatory state.

Such cases usually begin with considerable and painful swelling of the auditory meatus, which renders a diagnosis of the seat of the disease very difficult. When, by *avoiding* the usual ear lotions, a lessening of the swelling has been gained by careful cleansing of the ear, and by the use of rolls of charpie, then we may recognize, chiefly at the beginning of the bony part of the auditory meatus, granulations as large as a pin's head or a pea. In the act of digging these out with the sharp spoon, we often notice a distinct grating, and the contents of the spoon show small, black particles of bone.

In the cases in which such circumscribed necrosed parts are simply the result of disturbances of circulation, due to pressure from furuncles, or otitis externa diffusa, the simple removal of the necrosed particles of bone is sufficient for the perfect closing up and healing of the affected bone, for in these cases we have to do with an unindented bony surface, especially in otherwise healthy individuals, who suffer from no dyscrasia.

For the sake of brevity, I will take but two examples from a series of cases.

CASE I.—Treatment begun June 14th, 1873. Furuncle with frequent relapses! Granulations and necrosed particles of bone at the beginning of the bony auditory meatus. Scraped off with the sharp spoon. Cure.

Miss A. Sch., daughter of my colleague Sch., 21 years old, previously healthy, suffers for a year from furuncles of the right ear. The last eruption, three weeks before, was particularly painful, and an extremely necrosed nucleus of connective tissue had evacuated itself. The auditory meatus still somewhat swollen at the inferior wall of the bony part, and at its anterior portion, a granulation half the size of a pea. Hearing somewhat reduced, low voice 10'. Watch 2". The granulations were removed by the sharp spoon, and, in so doing, small, black particles of bone were found in the contents of the spoon. A moderate reactive inflammation of the external auditory meatus followed; four days later, lessening of the swelling, and restoration of normal hearing; ten days later, the small wound made by the operation closed up, and a lasting cure was gained, so that up to this time no more furuncles have appeared.

CASE II.—Treatment begun Dec. 28th, 1876. J. S., merchant, 31 years old, has suffered for six months from frequently recurring and very painful furuncles of the *left* ear; lately the cerumen has become thinner, and mixed with pus. Hearing distance somewhat reduced. In the external auditory meatus, there are many scales of epidermis, with thinned cerumen and some pus. On the inferior wall, at the beginning of the bony portion of the auditory meatus, there is a granulation the size of a pea, on digging out which, the sharp spoon grates on some rough particles of bone, and the contents of the spoon show some small, black particles of bone. Afterwards the ear is syringed out with a one-half-per-cent solution of carbolic acid* and then closed with small rolls of charpie. No reactive inflammation follows, and healing of the operated place ensues in eight days. Since then no relapses of furuncles.

After severe *otitis externa diffusa*, the epidermic lining of the external auditory meatus and of the membrana tympani often falls off in toto, and after many such sheddings, there gradually forms between the membrana tympani and the external air a firmly closing plug, behind which granulations and pus origi-

* At this point I would mention that, for a year and a half, I have operated antiseptically, in so far as to dip the instruments used into a solution of carbolic acid, to drop some of the same solution into the ear for a few days, and that since this time I have very rarely observed any reactive inflammation of the external auditory meatus after the various operations.

nate. In such cases we often see repeated attacks of facial erysipelas, which evidently have their starting point in the granulated and suppurating portion of the auditory meatus. After clearing away the masses of epidermis, and relieving the pressure which they cause as a foreign body, and on account of the unhindered entrance of atmospheric air, the granulations oftentimes shrivel without farther treatment, provided they were not already too compactly organized, and the bony part had remained healthy—or a slight pencilling with a small lump of argenti nit. melted on the end of a silver wire is enough to cause them to shrivel. The three following examples will serve to explain the above-mentioned form of disease.

CASE III.—Treatment begun Oct. 24th, 1868. Repeated attacks of facial erysipelas due to otitis externa diffusa, with consecutive formation of granulations. Cure.

Miss J. K., 28 years old, from Hanau, of delicate constitution, has suffered for six years with frequently recurring facial erysipelas. All possible precautions against catching cold, courses of baths at Nauheim and in sea-water have been unable to prevent the young lady from being visited every four or six months by the extremely painful affection, visibly affecting her bodily strength. As moreover, during the last six weeks, dizziness, headache, deafness, and tinnitus had come on, I was consulted.

I found the hearing distance reduced: *right*, watch 4"; low voice 12'; *left*, watch on contact; low voice 4'. Some thin pus was found in the moderately swollen and much reddened external auditory meatus (both sides), and at the bottom, some masses of epidermis, firmly wedged in, especially on the *left* side, in fivefold layers, representing, after its somewhat difficult removal, a cast of the auditory meatus. When this had been done, the grievous symptoms stopped, tinnitus and deafness were removed; but the auditory meatus (both sides) remained furrowed, and secreted some pus, the cause of which I was then unable to recognize, since the visible portion of the membrana tympani looked simply tarnished, but without any perforation. The air douche gave only the usual sound of the air striking against the memb. tym. A year and a half later, I saw the patient again. Until within a few days she had been spared from erysipelas, but now the beginning symptoms of that disease had appeared. The erysipelas

wanders over the forehead and bridge of the nose to the left side of the head. When the swelling of the parts had lessened, a considerable mass of epidermis was again removed from the right ear, and small granulations were seen near the annulus tympanicus, at the anterior wall of the external auditory meatus. In the *left* ear I found granulations at about the same spot, but there was less shedding of epidermis, and it was less compact. The growths disappeared after many repeated cauterizations with the silver wire tipped with argenti nit.; the purulent secretion gave way to one of a more ceruminous character, the lining membrane of the auditory meatus grew firm, and its sensitiveness lessened, the hearing distance became constant, and the general health, as well as the bodily strength, left nothing more to be wished for from this time forward. In the pretty long series of years since passed, the lady has never again suffered from erysipelas.

CASE IV.—Otitis externa diffusa, with formation of granulations on the processus brevis; spontaneous shrivelling of the granulations.

P. S., a saddler from Frankfort, consulted me on the last of April, 1876. The patient had undergone many violent inflammations of the right ear for several months without seeking help, and it was only through a suddenly occurring attack of extreme deafness, with intense tinnitus, a few days before, that he had been induced to take advice. The hearing distance on both sides was very much lessened; whispers not understood, loud voice at not more than 10' distant; watch on contact, both sides. The right auditory meatus, reddened and slightly swollen, contains many coarse masses of epidermis, covered with cerumen. After instillation of a solution of soda, I succeeded in loosening the mass, composed of about eight layers, by means of a sound, and then in extracting it. A granulation about $\frac{1}{3}$ the size of a pea appeared on the processus brevis of the somewhat furrowed membrana tympani. This shrivelled very rapidly during the next few days without medication, and in ten days the membrana tympani showed its normal brilliant tint. A coarse plug of cerumen had been the cause of the disturbance of hearing in the left ear.

CASE V.—Otitis externa diffusa with periparotitis; collapse during chloroform-narcosis. Foreign body pried out by means of the sharp spoon. Treatment of the subsequent periostitic obliteration of the bony portion. Cure.

J. W., 6 $\frac{1}{2}$ years old, previously well, came under my care April 10th, 1876.

The attack had begun four weeks before with feverishness, pain, and swelling of the whole neighborhood of the left ear and parotid gland, from which cause the physician in charge diagnosed it as an epidemic periparotitis. Later, a purulent flow from the left ear had set in, to stop which various astringent ear lotions, and lastly solutions of argenti nitras, had been instilled, but without success. At my first examination, the cartilage of the ear and the auditory meatus were of such a uniform black tinge that I could not accurately distinguish the regions in question; but it seemed to me as if some sort of foreign body lay in the depths of the auditory meatus. The hearing distance was very slight; 4' loud voice—ticking of watch not heard. After the ear had been carefully cleansed with luke-warm water for two days, I distinguished the foreign body, by the lamellar structure of its cut surface, as the half of a large bean, which rested, firmly wedged, in the bony portion, and seemed already entirely surrounded by slightly bleeding granulations.

The removal of the bean was made very difficult by various circumstances; it did not move nor shake when syringed with a powerful stream; pincers would only break off minute particles, the granulations would bleed and hide the field of vision, and above all, the boy was so irritable that he could not be forced to keep still. Longer waiting being precluded by the danger of retention of pus, and on account of the headaches already present, I decided to go behind the foreign body with a sharp spoon, while the patient was under chloroform, and then to lift it out from the auditory meatus. With the assistance of Surgeon W., the narcosis was undertaken with all due precautions. The boy lay in a semi-recumbent position, at first boldly opposed the chloroform, but just as I was on the point of introducing the sharp spoon, I noticed that he rapidly collapsed—it was a frightful moment. It was only with difficulty that I succeeded in jamming open the convulsively closed lower jaw, in drawing forward the tongue with the hooked forceps, and after removal of the mucus on the epiglottis, in bringing on regular respiration. But it was not until at least half an hour later, that the powerless state into which the boy repeatedly relapsed gave way to a more powerful activity of the heart, under the action of strong irritants. In the evening I found the patient well again; then I first learned from his mother that he had coughed a great deal during the night before, and then I confirmed the presence of a slight bronchial catarrh, which in all probability, together with its hindrance to respi-

ration, had been the cause of the unfavorable accident. A few days later I succeeded in making the boy hold still, by threatening him, and *then going behind the bean with a sharp spoon, I pried it out with a quick and powerful motion.*

The hearing distance instantly increased to low voice 20'. The bony auditory meatus was already considerably narrowed by periostitis, and now came on the rare event* of the irritation developing a tendency toward a perfect cicatricial and cuticular obliteration of the auditory meatus, and that in spite of the removal of the foreign body, and in a boy afflicted with no dyscrasia. Energetic destruction of the successive growth of granulations with the usual caustic did not prevent a repeated temporary cutaneous closure of the auditory meatus. Even the insertion of laminaria remained unsuccessful in this period, for it was repeatedly pushed aside, and pressed out from the obliterating spots, by the swelling of the periosteum. In this way, the hearing distance was again extremely lessened.

After this condition had lasted fourteen days, and the cauterizations remained unsuccessful, I entered with the sharp spoon, came upon a rough patch of bone on the inferior wall; hereupon a small plate of bone at once fell off; probably this had kept up the swelling of the periosteum, for under simultaneous repeated introduction of rolled strips of sticking plaster, renewed every two days by a fresh bit, we now succeeded in keeping the passage of the auditory meatus open. The swelling of the periosteum disappeared, the granulations shrivelled spontaneously, and a perfect cure was gained after a course of treatment lasting six weeks in all.

When, in our consideration of the diseases now in question, we pass from the more exterior to the deeper seated forms, we next meet with those cases of *purulent inflammation of the middle ear* in which the exuberating granulations forming in the region of the gap in the membrana tympani lie hinderingly in the way of the closing up and healing of the membrana tympani. Since the *anterior inferior quadrant* of the membrana tympani is preponderatingly the seat of perforations, we find the base of these granulations at the inferior wall of the tympanum by preference, or in the sometimes pretty narrow

* In the literature accessible to me, I find no analogous case described, up to this date.

angle which the membrana tympani forms with the inferior wall of the auditory meatus. In a narrow auditory meatus, and one curved anteriorly and inferiorly, even after the swelling has lessened, there is need of a very careful cleansing of the parts from the lamellæ of epidermis now and then covering them. For this I use by preference a fine sound, in order to confirm the presence of granulations and to remove them at once with the sharp spoon. Naturally, such an operation can only be well done by favorable daylight. If, on cutting the granulations out, we come upon patches of rough bone, which are often found at the annulus tympanicus, then we may scrape them off less roughly, because here we have to do with no bony districts of importance, either physiologically or acoustically, the wounding of which would be different. Moreover, the bone at this region is almost always merely superficially eroded, and it is rare that more than two such operations, of course with a pause of several days, are needed; we must also watch carefully any possible formation of scars before we decide to repeat the operation.

CASE VI.—Accumulation of epidermis in the bony portion of the auditory canal. Otitis media. Patch of carious bone with granulations springing from the anterior lower quadrant and extending to the floor of the tympanic cavity. Cure after six weeks' treatment.

Mary M., æt. 33, cook from Hanau, had suffered several months from noises in her ears and hardness of hearing. One week before she consulted me, January 10th, 1877, she began to complain of intense headache, earache, and dizziness. The hearing distance measured 6' for loud voice; ticking of watch was not heard. The left external auditory canal was much swollen and contained anteriorly a small quantity of cerumen; the bony portion was completely filled with tenacious, fetid epidermoidal accumulations. When the swelling had subsided, I succeeded with some difficulty in loosening the scales, and removing them with the forceps. The patient felt better immediately; the noise, headache, and dizziness disappeared. The membrana tympani appeared reddened and swollen. Upon applying the air douche, distinct râles were heard in the tympanic cavity, no perforation whistle. The hearing distance increased to 10' for whispering voice. Ten days later, the secretion of pus was still profuse and fetid, though the drum-

head had begun to clear up. I then discovered that the suppuration proceeded from a mass of granulations springing from a niche situated at the edge of the annulus tympanicus and extending to the floor of the tympanic cavity. The lower segment of the annulus tympanicus had a notched appearance. On account of the angular course of the bony portion of the auditory canal, the above-mentioned niche could be reached only with difficulty. I finally succeeded by directing the cutting surface of the sharp spoon decidedly downward. After scraping away the granulation mass filling the depression, I found black particles of bone in the contents of the spoon. After the operation, the air passed whistling through the tympanic cavity, and the hearing distance was increased to 22' for the whispering voice, and 8" for the ticking of the watch. The patient returned after twelve days. Upon examination, I found the seat of operation covered with thick pus, and the depression filled again with granulations. I removed the latter in two sittings at intervals of five days. The second time I could not discover any rough bone. In the course of a few days, the drumhead became perfectly normal as regards its lustre and tension; the light spot reappeared and the hearing distance increased.

Twelve days later, and the end of February, the seat of operation showed a crescent-shaped white cicatrix measuring 5 mm. in width, and 3 mm. in height, and extending downward from the lower limiting line of the membrana tympani. The two accompanying cuts illustrate these conditions sufficiently.



It is possible that in the beginning the case was one of suppurative subacute otitis, which was followed by otitis externa, consequent upon necrosis of a small portion of bone at the floor of the tympanic cavity and at the edge of the annulus tympanicus. This otitis externa, with its large deposits of epidermis, may have caused pressure upon the membra tympani and all the grievous symptoms.

CASE VII.—Purulent inflammation of middle ear; granulations in the anterior inferior quadrant. Cure by formation of a scar after eight weeks' treatment.

Madame G., 30 years old, a delicate woman, came under treatment Nov. 5th, 1876. She had noticed for several months a varying deaf-

ness of the right ear; within three weeks more acute symptoms, such as pain, tinnitus, discharge from the ear, and heavy feeling in the head, had come on. The hearing distance was 3" for the ticking of a watch, 8' for whispered words. The external auditory meatus seemed swollen by inflammation, the membrana tympani softened and bluish-red, partly covered with purulent secretion, its anterior inferior portion invisible on account of the swelling of the auditory meatus. On using Politzer's air douche, the air passed through hissing, with relief. After eight days' treatment by the above-mentioned method, the swelling had lessened so much that a small perforation in the anterior inferior quadrant, and below it a granulation the size of a pea, could be recognized. Cauterization next followed by means of the silver wire tipped with argenti nitras. A very painful inflammation of the auditory meatus, the external ear, and its whole anterior neighborhood, accompanied with fever and a noticeable falling off in bodily health, now followed, which reduced in an extreme degree the strength of the delicate woman. When this inflammation stopped, the granulations, which had grown in the mean while, were cut off with the sharp spoon (on account of the narrowness of the auditory meatus, it was hard to reach the base of the granulations with the spoon), but they grew again in a few days and had to be removed a second time; in doing which a few small, black particles of bone appeared in the contents of the spoon. No inflammatory reaction followed the operation; the perforation healed up, and the hearing distance increased to the normal standard.

CASE VIII.—Purulent inflammation of the middle ear, granulations, and spots of carious bone in the region of the anterior inferior quadrant.* Cure after four weeks' treatment.

H. A., tailor, from Edenkoben, 27 years old, pale and slender, otherwise well by his account, began treatment November 10th, 1876. He had noticed some purulent secretion in the *right* ear for several weeks; within eight days, violent pains, tinnitus, and a high degree of deafness had come on. He could not hear the watch at the external auditory meatus, nor when applied to the temple, loud words were understood only quite close to the ear. There was a purulent, offensive secretion in the much swollen auditory meatus; the posterior portion of the

* For the sake of brevity, in the following cases, I shall use the division of the membrana tympani in such a way as to divide the field of operation into four quadrants, and then comprehend the bony district lying at the periphery of each quadrant under the term "quadrant."

membrana tympani was livid. On using the air douche, a rattling entrance of air was gained with difficulty, but the patient at once felt relieved, and hearing distance increased to: watch on contact, low voice 2', loud voice 15'. Ordered two leeches over the mastoid process, mineral waters, daily air douche by means of catheter.

Eight days later, the auditory meatus was so much less swollen that we could recognize in the anterior inferior quadrant a granulated mass, the size of a lentil; on removing this by the sharp spoon, it seemed to have sprung from in front of a carious spot, which stretched away into the inferior wall of the tympanum; then, on using Politzer's method, the air hissed freely through the gap in the membrana tympani. Syringing with a solution of carbolic acid; no inflammatory reaction. The carious spot of bone had twice to be scraped roughly, then it healed, and after four weeks' treatment, the conditions of the tympanic apparatus were again substantially normal.

CASE IX.—Purulent catarrh of middle ear, right side, with formation of granulations on carious bone in the anterior inferior quadrant. Cure after six weeks' treatment. Chronic catarrh of left Eustachian tube.

G. K., 41 years old, a well-nourished butcher of Frankfort, came under treatment Oct. 2d, 1876. He had frequently suffered in childhood from ear-aches and varying degrees of deafness, but in manhood his hearing had become pretty fair. After an influenza he had noticeable deafness on both sides for two weeks. Right side, violent pain, tinnitus, and purulent discharge. Hearing distance: Right, $\frac{1}{2}$ " watch; whispered words not heard; loud voice not heard beyond 10'. Left, watch 1"; loud voice 12'.

Right membrana tympani drawn in; in the anterior inferior quadrant a perforation with an overlying granulation which springs from a carious base; the air douche produces a hissing sound with difficulty. Single scraping of the diseased bony part; instillation of solution of carbolic acid. No farther inflammatory reaction. Closing up and lasting readjustment of the membrana tympani after six weeks. Hearing distance for watch 8", low voice 28'.

The nose was narrow, its mucous membrane much relaxed, and as nearer examination showed, there were granulations at the opening of the tube. Ordered: nasal douche with luke-warm water and milk, pencilling of the nose, now and then, with argenti nitras, glycerin solution. Blowing of pulv. alum into the naso-pharyngeal space. Under this medication and with help of Politzer's method, the *left* ear also im-

proved, so that the hearing distance at the close of treatment was, 10" watch, 34' low voice, and has since remained pretty constant.

CASE X.—Acute purulent inflammation of the middle ear. Granulations in the anterior inferior quadrant. Relative healing after five weeks' treatment.

F. T., 24 years old, a merchant of Havre, came to me April 4th, 1876, on account of a painful disease of the ear from which he had suffered for eight weeks there. Violent pains in the head and ears, tinnitus and deafness, offensive discharge from the right ear.

When he reached here, the hearing distance was much reduced; watch just heard on contact. Loud voice 10'; low voice not heard. Air was forced into the tympanum with difficulty by Politzer's method. The auditory meatus very much swollen and sensitive; the posterior portion alone of the membrana tympani visible as a bluish-red surface. After a treatment of twelve days, a granulation as large as a small pea showed itself in the anterior inferior quadrant of the membrana tympani, which was cut out by the sharp spoon from the edge of the perforation; no inflammatory reaction followed the instillation of the carbolic acid. The suppuration lessened at once, the secretion became more viscous, serous, stringy, and after five weeks' treatment the membrana tympani was clear, but a perforation a little larger than a pin's head remained. I saw the patient again on the last of December; the perforation was still present, but in the auditory meatus there was a ceruminous secretion; the hearing remained constant—6" watch; 20' low voice.

Next to the *anterior inferior* quadrant, in which most perforations are observed, there is also another favorite spot for granulating growths, viz., the district of Shrapnell's membrane, or that segment of the outer wall of the tympanum where the membrana propria is wanting; possibly the slighter resistance of the membrane against the pressure of the column of air, thereby postulated, is the reason why it is relatively more often destroyed at this spot. Besides this, the posterior pouch of Trötsch, at the inner side, favors a longer retention of pus, and therewith erosions and caries of the neighboring bone. A very noticeable percentage of the operations concerned the posterior superior quadrant toward the region of the posterior pouch of Trötsch.

Many structures of quite important dignity are here brought into account, at first, the chorda tympani, which is sometimes destroyed by the suppurative process itself, although it offers porportionally a remarkable and longer resistance than even the bone. On operating with the sharp spoon in this region, in cases X., XI., XIV., XV., an irritation of this nerve was caused, so that alterations in the sense of taste could be observed, for longer or shorter time, in the anterior third of the tongue, to which this nerve is distributed. I have never yet noticed a lasting unilateral weakening of taste at the point of the tongue, in any cases operated upon.

Moreover, the preservation of keen taste does not seem to me as anything, in comparison with the danger of a deeply burrowing suppuration of bone; I shall therefore not be afraid of utterly destroying the chorda, when I have in view the healing of the ulceration of bone in question, by means of deep scraping.

If we go behind the processus brevis of the malleus with the sharp spoon, and above it and slightly deeper, then we strike, beneath the path of the chorda, or even through it, the long arm of the incus; farther upward we might touch the articulation of the malleus and incus, presupposing the outer bony wall of the tympanum defective; here also care is ordered, and we should only scrape superficially. In another series of cases, the diseased bony patches lie more towards or even in the *posterior inferior* quadrant; here in a posterior direction we touch the mastoid cells, which can be scraped roughly without harm.

The following cases of operations, which concern the *posterior superior*, as well as *posterior inferior* quadrant, will serve to explain more closely what has just been said.

The district of the *anterior superior* quadrant, of which I bring no examples, is fortunately that bony portion of the outer tympanic wall least frequently attacked by caries; were this not so, our statistics of ear diseases resulting in death would be far more unfavorable than it already is; for the plate of bone separating this section of the bony auditory meatus and

anterior superior portion of the tympanum from the dura mater is here most slightly developed, indeed it sometimes stands in direct union with the membrane of the brain, by vessels running through fissures in the bone. When I find granulations in this region, I content myself with their simple removal, but should not decide to act energetically upon the bone itself, with the sharp spoon.

When there is a large defect in the membrana tympani, we can see, as is well known, the corresponding portion of the inner or *labyrinthine* wall of the tympanum widely exposed. The mucous membrane on the promontorium is found furrowed and covered with fine granulations; sometimes larger, more polypus-like granulations are developed. Caries of this portion of bone does not often come under observation, for, on the one hand, the substance of this bone is very firm and resisting, and, on the other hand, its circulation of blood is less influenced by pressure from exudations than at the outer tympanic wall. On the contrary, cases of caries of the head of the stapes, and even of both of its arms, are more often mentioned—a fact which explains itself by the easier caused disturbances of nutrition in this small bone, when the circulation of blood is interrupted.

The relaxed and finely granulated mucous membrane of the labyrinthine wall, due to neglected suppuration, diminishes quickest when treated with strongly concentrated luke-warm solutions of argenti nit., neutralized directly afterward by common salt.

CASE XI.—Purulent inflammation of middle ear on both sides, during the measles. Pleuritis. Development of a scrofulous dyscrasia. Right, caries in posterior superior quadrant. Repeated recurrence of granulatory growths. Relative cure. Time of observation, $5\frac{1}{2}$ years.

L. B., 6 years old, had a severe attack of measles at Baden-Baden, in June, 1871. Even before the outbreak of the exanthem, pain came on in both ears after a stoppage of the nose, followed by a purulent secretion, with extreme deafness. Towards the end of the fourth week of the measles, pleuritis supervened (possibly due to the resorption of pus from the tympanum), which not only dangerously threatened life, but

so deteriorated the development of the child, that during convalescence a scrofulous dyscrasia unfolded itself. I found, at my first examination in December, 1871, six months after the beginning of the attack, chronic swelling of the nasal mucous membrane, of the glands of the neck and throat, periostitic swelling of the bony auditory meatus on both sides, and of the middle phalanx of the right middle finger.

When the swelling of the *right* inferior auditory meatus was somewhat less, the membrana tympani seemed thickened and relaxed; there was a perforation as large as a lentil in the anterior inferior quadrant, and a granulation half as large as a pea in the posterior superior quadrant at the annulus tympanicus. Hearing distance very slight: watch on contact; loud voice 6'.

Left ear, the deeper parts were hidden from sight for a long time by the swelling of the auditory meatus. Hearing distance very slight: loud voice 2', watch weak on contact.

An examination of the organs of the chest showed to the right and behind the scapula, and up to its angle, dulness and pleuritic friction sounds.

Course and treatment: Strengthening remedies were at once used, and Politzer's method, and later, various solutions of lead, zinc, and argenti nit. were instilled. *Right*, the lining of the tympanum gradually lessening in swelling, the secretion became more mucous, but the perforation and the granulation remained unaltered. Hearing distance increased; watch 2', loud voice 20', whispered voice 3'.

The swelling of the periosteum lessened very gradually, *left*; by March, 1872, a coarse polypus as large as a pea was seen at the bottom of the auditory meatus. But at the same time, attacks of dizziness and vomiting came on, which induced the anxious parents to allow the operation for removal of the polypus springing from the inferior wall of the tympanum. When the polypus had been crushed off, the symptoms of pressure disappeared, vomiting and dizziness did not return, suppuration lessened, but the hearing distance did not decidedly increase, because the lining of the tympanum remained in a state of chronic inflammatory hypertrophy, so that the air only entered rarely and with difficulty on using the air douche. The granulation, *right*, was cauterized in the following weeks with argenti nit. in substance; the mucous membrane, *left*, with a concentrated solution. In May, a swelling of the periosteum on the mastoid process came on with feverish chills which, however, retreated after using warm cataplasms. Iodine

and cod-liver oil were given abundantly without causing absorption of the scrofulous hyperplasia on the middle finger; but the pleuritic friction râles, and dulness about the scapula disappeared, and the general health improved. Toward the end of the summer of 1873, a relative cure came on in so far that the granulation, *right*, shrivelled after repeated energetic cauterizations, the membrana tympani cleared up, the mucous membrane of the tympanum, visible through the gap, appeared more yellowish-red, and cerumen spread over the auditory meatus. Hearing distance: low voice 15', watch 6'. Exuberant growths could not be prevented in the *left* ear, and a larger scar formed in the anterior inferior quadrant. Hearing distance still slight: loud voice 6'. Tinnitus was never complained of. About this time, too, the hyperplasia on the middle finger grew smaller, the first phalangeal joint became movable, and the finger regained its normal contour.

In reaching this result, so favorable on the whole, a prolonged sojourn in the mountains and saline baths of Berchtesgaden were certainly not uninfluential. The condition did not change, and during 1874 and '75 the boy had coryza with slightly more mucous secretion, and slightly less hearing distance of the *right* ear; this improved again after using Politzer's method; he went to college and made pleasant progress.

But in February, 1876, in union with renewed scrofulous swelling of the glands of the neck and throat, there came on some symptoms of the *right* ear, which kept me for a long time in great anxiety, not only on account of the threatened hearing, but even of the life of the promising boy. A spongy granulation, with greatly increased offensive secretion, grew in the course of a few days at the former mentioned spot in the posterior superior quadrant, down over the posterior half of the membrana tympani, and reduced the hearing so much that loud words could be heard at only 4'. The danger that the unhealthy pus would dissolve the rest of the membrana tympani was near at hand.

I therefore, when the patient was under the influence of chloroform, cut off the granulating mass, but noticed that it did not grow smoothly from the rim of the membrana tympani, but from a hole in the bone as large as a pea, which, also filled with granulations, stretched inwards towards the chorda and back wards toward the mastoid cells. I therefore scraped it out at once, and found numerous black, necrosed particles of bone in the contents of the spoon. The patient felt very comfortable after the operation, and perceived nothing but the characteristic alteration of taste due to the irritation of the chorda. The

hearing distance at once reached its former amount : 15' low voice. No inflammatory reaction followed the instillation of carbolic acid.

But just three weeks later, the growth started anew, grew very fast, and was again removed as before, and again there were black particles of bone in the spoon after scraping the hole in the bone. I grew anxious with the idea that the rapid second growth of the granulation was to be looked at as a symptom of progressive caries ; and that this might attack, anteriorly and superiorly, the tegmen tympani, destroy the bone, and affect the dura mater. Fortunately, the patient showed no symptoms of any irritation of the brain. And thus, renewed growth of the granulation and the operation of scraping out, always under chloroform, the hole in the bone, succeeded each other, four times in all, from March to May, 1876 ; at last no more necrosed particles came off by the spoon, and the wound closed over. The swelling of the glands also disappeared under use of cod-liver oil and salt-baths. A longer sojourn in the mountains and sea baths at Blankenberge caused such an improvement in his constitution that Louis B. is now blooming and healthy, and able to keep a good place in the second class of the college ; for his hearing, *right*, is 15' low voice ; 8'' watch. The adhesions in the *left* tympanum will not allow an improvement of hearing beyond loud voice 6'.

CASE XII.—Acute purulent inflammation of right middle ear. Granulations in tympanum removed with the sharp spoon. Cure after seven weeks' treatment. Disease of *left* middle ear three months later. Paracentesis of membrana tympani. Cure after five weeks. Time under observation, one year and a half.

E. H., valet, 34 years old, pretty well nourished, pale face, occasional cough and plegm, but never having any disease of his ears, was seized, while travelling, about the middle of Oct., 1875, with intense pain, tinnitus, deafness, and suppuration of the *right* ear. He returned to this place in the third week after the attack, and when he came under my charge, there were already extensive alterations present. In the right external auditory meatus, which was swollen, there was a great deal of offensive secretion, the membrana tympani relaxed, livid, its posterior half *curved forward*, and granulations sprang from the perforation occupying the middle third of the posterior half. The air hisses through with difficulty on using the air douche. At the same time the general state of the patient was very bad ; he was worn out by furious pains at night, feverishness, irritating cough and loss of appetite, and then came on an attack of dizziness, proably due to the pres-

sure of granulations on the membrane of the fenestra rotunda. Examination of the chest showed an extensive râle, but no dullness, in various districts; there were strong suspicions of beginning phthisis. Hearing distance very slight; watch o, loud voice not more than 6'.

As the patient's state was not improved after fourteen days' use of the air douche and various astringents, and even a concentrated solution of argenti nit., I decided to operate; taking the sharp spoon, I first cut off the rather coarse growths springing forward through the perforation, penetrated then into the tympanum, turned the spoon upward, cleared out the rest of the granulations towards the posterior pouch of Tröltzsch, and reached, in the direction of the mastoid cells, a patch of rough bone which I scraped out. Then a careful cleansing with carbolic acid solution.* After the operation, the patient felt very much relieved, the dizziness and the fearful ache in the head spreading out towards the crown, as also the tinnitus, disappeared; on the other hand, he perceived the characteristic alteration of taste due to irritation of the chorda, which, however, disappeared in a fortnight. On the next day, the hearing distance was: 10', low voice. Ten days later, a granulation, half the size of a pea, growing forward from the inferior edge of the perforation, was properly crushed off. The secretion thereupon became viscid, the membrana tympani began to clear, the gap closed. By the end of December, ten weeks after beginning of attack, the membrana tympani had already regained its lustre, and showed nothing abnormal but a linear, white scar at the place of operation. The hearing distance was somewhat weakened in contrast with the normal; watch 2'', low voice 25'; and a slight hissing tinnitus continued. The bodily powers were noticeably increased, and an examination of the lungs showed them to be in good order.

Three months later, the hitherto healthy *left* ear became affected by exposure to a raw north-east wind, with symptoms of acute inflammation of the middle ear. As on the 21st of March, the posterior part of the membrana tympani seemed much curved forwards, paracentesis was done, and a moderate amount of serous, viscid fluid was driven out by Politzer's method.

The inflammation ran a much milder course than that of the right ear, thanks to therapeutic management begun at the right time. There was no formation of granulations, and the cure was completed in four

* I remind my readers, once for all, that syringings after operations are very painful; we should only rinse out very cautiously.

weeks. Up to this time, a year and a half from the first attack, E. H. has been well, and the only thing noticeable is the slight resistance of the mucous membrane of the respiratory tract against harsh weather. The slightly lessened hearing distance, and the hissing tinnitus, probably due to some thickened spots in the lining of the tympanum, are unchanged.

Since from the above-described case we have gained proof that we can penetrate with the sharp spoon *through the opening of a perforation*, towards the posterior section of the tympanum, and, without risking any subsequent disturbance of function, can clear out the growths therein recognized, indeed must clear them out unless we will allow the formation of adhesions, which, when contracting, will lead to high degrees of disturbance of hearing, so now, the two following cases prove that the relatively normal membrana tympani can be incised, and the growths in the tympanum, recognized by means of the sound, can be removed therefrom by the sharp spoon, without running the risk of a subsequent reactive inflammation.

CASE XIII.—Variola vera, with otitis media, both sides. Removal of epithelial growths from the right tympanum. Cure after eight weeks' treatment.

J. K., 62 years old, a baker from the Wetterau, fell ill of variola vera in the middle of February, 1876. Towards the end of the second week of the attack he felt heaviness and pain, with violent knocking tinnitus (like threshing) in both ears. Later, some moist secretion came on, but no real suppuration, and at the same time the deafness increased quite gradually. The constitutional disease ran a moderately severe course, the eruption of pustules was thickest in the face and on the head, and owing to its confluent nature, a facial erysipelas came on in third week of the attack. Convalescence began only towards the sixth week.

On May 16th, ten weeks after the beginning of the ear affection, I found the following condition at my first examination: in the face, numerous small-pox scars, moderately pigmented, and pretty closely crowded, but only a few on the external ear and in the external auditory meatus.

Right ear.—There is a large amount of epidermic scales, mingled

with secretion, in the external auditory meatus which is still swollen in its bony portion. The membrana tympani is not clearly to be seen. The auditory meatus, extremely reddened deeper in, passes over uninterruptedly into a hemispherical mass, curved forward, reddish-brown in color, flushed, and shining like jelly, and which seems to occupy the whole space of the posterior half of the membrana tympani. Hearing: watch 0; loud voice only at 1'. The air from the douche enters only with difficulty, with a very perceptible rustling, but immediately afterwards the hearing improves; whispered voice, 2'; loud voice, 12'.

Left ear.—Scales of epidermis, mingled with secretion, in the much swollen and reddened auditory meatus; the membrana tympani, which is drawn inward, shows a more distinct contour than that of the right ear, but it is extremely puffed up and thickened, so that the handle of the malleus cannot be seen. Hearing distances: loud voice, 4', watch on contact. Somewhat difficult entrance of air with rustling on using the air douche, but the hearing is at once improved; loud voice, 12'.

The patient was much relieved by the use of the air douche; "he now feels his head again!" Tinnitus also grew weaker, and the mental disposition, which on account of the great pain in the ear had been despondent, improved.

Course: as the hearing of the *right* ear did not improve any farther after using the catheter for ten days, and as the peculiar bulging of the posterior portion of the membrana tympani (which, owing to decrease of swelling of the auditory meatus, could now be more clearly recognized as the membrana tympani, and the corresponding part of the tympanum) still remained constant, I first made an exploratory puncture into the growth; only one drop of blood escaped; the configuration of the curvature remained as before. A few days later, I decided to operate with the sharp spoon. First of all I made an incision into the bulging portion of the membrana tympani, then entered the tympanum with the sharp spoon, and cleared out the jelly-like masses which filled the posterior inferior section of the tympanum. There were no black particles of bone in the hollow of the spoon, but simply the masses which will be more clearly described farther along. The result of the operation was excellent, the hearing rose to, low voice 8', the air now hissed freely through the tympanum. Instillation of carbolic acid. No inflammatory reaction. Three days later, the contours of the membrana tympani were already more distinct, the handle of the malleus could be seen; the scar began to form in eight days, and the membrana

tympani became more gray. After-treatment: air douche, or Politzer's method, every other day. By July the hearing was: watch 4'', low voice 20', then the membrana tympani cleared up, and at the beginning of August, a white, linear scar could be seen in the now normally glistening membrana tympani, and near the annulus tympanicus.

The *left* ear gradually improved by use of the air douche, the membrana tympani cleared up, the tinnitus disappeared. At the last examination, at the end of October, the hearing of Mr. J. K., considering his advanced age, was quite normal.

Wendt, in his excellent article,* says:

"I found the mucous membrane swollen in a *polypoid fashion*, or *growing exuberantly*, in twenty-nine tympani. Next to an inflammatory swelling, *hyperplastic processes* are to be regarded as the cause of the immoderately great and usually more important increase in volume of single spots, quite evidently at least in those cases distinguished by remarkably moderate formations. As to the *configuration of the upper surface*, it was raised into solid *nodules, granules, tufts, knobs, or flaps*, and that at single spots, or in greater extent, or to *excrescences of considerable circumference*.

At another place (page 156), Wendt describes the epithelium in microscopic sections.

"A thickening of the epithelium had arisen from two causes, first by an increase in the number of its elements, second by an *increase in their volume*.

"Perpendicular sections showed three, four, and even more overlying rows of cells, the external of which had preserved the original form of an epithelium, while the rest were swollen into a more or less globular shape, and while giving a dull reflex, yet appeared bright, and held a few pus corpuscles here and there."

I found precisely the same on a microscopic examination of the masses removed with the sharp spoon; they were made up to a preponderating degree of several layers of overlying and swollen epithelial and fresh connective-tissue cells.

* "On the Behavior of the Ear and Naso-pharyngeal Space during Variola." Archiv der Heilkunde, 1872, page 153 et seq.

In the *right* tympanum our case had gone on to a formal hyperplasia of epithelium, with beginning organization of connective tissue, while in the *left* tympanum the process had not gone beyond the thickening of the epithelium (visible in the loosened and thickened membrana tympani) and a collection of viscid masses of secretion. The result is to be regarded as extremely favorable, considering the advanced age of the patient.

CASE XIV.—Otitis media chronica, with exuberating granulations without perforation of the membrana tympani. Cure after six weeks' treatment.

Willy W., eight years old, has often suffered, during several years, from pain in the *right* ear, in which some moisture has been occasionally noticed. When he came under charge, his hearing distance was, watch 2', low voice 6". There has been occasional tinnitus, but never any dizziness. The posterior portion of the membrana tympani seems reddened, curved forward, much loosened, partially covered with secretion. As no improvement was gained after three weeks' use of Politzer's method, and no change in the bulging portion of the membrana tympani, I concluded that this curvature was due to granulations lying behind it; so I made an incision, and no change of curvature following, I then entered with the sharp spoon, and cleared out all that I found in the shape of granulating masses, which were pretty coarse in structure. No necrosed particles of bone in the spoon. The air at once passed freely through on using Politzer's method. No inflammatory reaction followed, and a fortnight later the wound in the membrana tympani was healed over, and the hearing became altogether normal after six weeks' treatment.

The patches of carious bone, which belong to the posterior inferior quadrant, offer, on the whole, more favorable chances for healing, and rarer relapses than those of the posterior superior quadrant—a fact which is explained by the less hidden seat of the bony particles to be scraped out, and by the more even, less indented surface of that portion of the posterior inferior quadrant coming into consideration in the field of operation.

The three following cases, which concern the posterior superior quadrant, were more tedious and more complicated on

account of growth already existing for a long time within the tympanum; we succeeded, after long treatment, in healing the diseased portions of bone; the disturbances of hearing resulting from the growths described, remained partially constant. These are the cases marked in the heading "relative cures."

CASE XV.—Otitis media chronica, right ear. Spots of carious bone, with granulations in the posterior superior quadrant. Relative cure. Catarrh of the tympanum, *left ear*. Cure after tonsillotomy. Time of observation, $1\frac{3}{4}$ years.

Von L., student, 18 years old, began treatment April 19th, 1875. The disease of the ear had begun ten years before, during an attack of measles (the case resembles No. X. very much) and otorrhœa and deafness followed, *right*. But within a few days Von L. had noticed tinnitus and deafness in the previously almost intact *left ear*, which condition gave him more inducement to consult me than the suppuration of the *right ear*.

Present state.—*Right*: there was much offensive, cheesy secretion and masses of epidermis in the loosened external auditory meatus; above and behind the processus brevis of the malleus, a perforation half as large as a lentil; behind it, in the posterior inferior quadrant, soft, granulating masses as large as a pea, springing from a crevice. Hearing distance: watch 3'', low voice 1', loud voice 10'.

Left: membrana tympani drawn in, swollen somewhat from inflammation. Hearing distance; watch 1'', low voice 3', loud voice 14'. On using the air douche, hissing *right*, entrance with rattling sound *left*. The hearing distance thereupon increased; *right*, low voice 8'; *left*, low voice 25'.

Progress: as the *left* tonsil was much hypertrophied, it was removed with the tonsillotome; under use of Politzer's method, the affection of this ear healed quickly and up to this time it has remained well.

The treatment of the *right ear* offered great difficulties. Cauterization of the granulations caused intense reactive otitis externa, the disagreeable suppuration kept on, but the treatment was often necessarily interrupted, as the patient was here only in the holidays.

In June, 1875, the granulations were removed with the sharp spoon, and the spots of carious bone, found in an indentation of the posterior superior quadrant, were scraped out three times, with pauses of a few days, but probably not boldly enough, for in December, noticeable

granulations had again sprung from it. In the mean time, repeated and very painful otitides had set in, probably due to a spontaneous loosening of a small particle of bone. The parts concerned were roughly dug out once more under chloroform, and a pretty large number of necrosed, punctiform particles of bone removed. The subsequent irritation of the chorda, which lasted a fortnight, seemed to me a symptom that the spoon had caught hold of the bony portion in a satisfactory manner. The wound in the bone then healed, the membrana tympani grew clear, and cerumen began to be secreted in the external auditory meatus. The small perforation above the processus brevis of the malleus lasted; hearing distance moderately reduced, watch 3'', low voice 8'. At the last examination, in December, 1876, a year after the last operation, the condition was still as favorable.

CASE XVI.—Large polypus snared off, right. Suppuration stopped. Relapse with carious spots of bone in the posterior superior quadrant. Relative cure. Under observation 2½ years.

Miss A. S., from Saxony, 18 years old, a strong and healthy-looking brunette, came under my charge in the beginning of November, 1874. She had suffered for eight years, after a disease of childhood, from offensive suppuration and almost complete deafness of the *right* ear. Within eight days, she has complained of fearfully tormenting pains in her head and ears. Inspection shows in the external auditory meatus a tough polypus of such size that it reaches even to the entrance. Hearing distance on this side absolutely null, for voice and watch. The polypus was removed by the snare at two sittings, and an offensive, cheesy, purulent mass, mingled with lamellæ of epidermis, was syringed out; great relief followed. The pedicle of the polpus, which originated in the posterior superior quadrant, was repeatedly cauterized. When the swelling of the parts had ceased, the membrana tympani was seen to be immovable, probably due to adhesions within the tympanum. With the air douche, difficult entrance, no hissing through. Hearing distance increased to, watch 2'', low voice 6', loud 12'; the purulent secretion ceased, and on leaving, January 6th, 1875, she already had a secretion of cerumen in the auditory meatus.

In November, 1876, almost two years later, Miss S. came back to me, because for eight days she had again felt violent pain in the head and *right* ear, and some suppuration had been present for a number of weeks. I found a rather soft, granulated mass, about as large as a pea, at the end of the auditory meatus and removed it with the snare. But again be-

hind it there was a heap of offensive cheesy masses, which seemed to come more from an indentation behind and above (compare case XIV.). The suppuration went on after removal of the growth ; when the swelling of the parts had lessened, I penetrated with the sharp spoon (bent extremely on its plane) around the projection of bone in the posterior superior quadrant, and in this way could scrape out coarsely the rough particles of bone, which, judging from the subsequent irritation of the chorda, evidently extended far into the tympanum. Instillation of carbolic acid. No inflammatory reaction followed, not even after the second, necessary repetition of the operation. The hearing, which had been extremely decreased, arose to : watch 3', low voice 6', and in January, 1877, the patient, who had been very down-hearted about her sufferings, was sent homewards relatively cured.

CASE XVII.—Spots of carious bone in the posterior superior quadrant. Stoppage of suppuration after two scrapings.

Mrs. H., 36 years old, from Essex, came under my care in July, 1876, after already consulting a long list of specialists for her disease of the *right* ear, which had lasted six years. A spot of carious bone, as large as a small pea, lying in the posterior superior quadrant, hidden behind a projection of bone, was at last, after many examinations, diagnosed as the cause of the suppuration. The handle of the malleus was drawn extremely inwards, and adhesions in the tympanum were the probable cause of the high degree of deafness. The suppuration stopped after two scrapings ; the hearing distance remained slight, loud voice, 8'. Time of observation, eight weeks.

Here follow some cases operated upon in the posterior inferior quadrant. With the exception of the tuberculous case, they offer, on the whole, a very favorable result.

CASE XVIII.—Chalky deposits in the membrana tympani. Spots of carious bone in the posterior inferior quadrant, healed after four weeks' treatment.

F. L., merchant, 18 years old, a strong young man, when a child suffered now and then from otorrhœa and pain in the ears ; later, a pretty constant deafness, *left*. Hearing distance, watch on contact, loud voice 10'. Within a year, the discharge has increased, and is very troublesome, on account of its bad odor. Cheesy, offensive masses of suppuration and epidermis in the external auditory meatus. The mem-

brana tympani is completely calcified; in the posterior inferior quadrant there is a granulation half as large as a pea, with a spot of carious bone underlying it, and stretching away into the tympanum. After scraping out, a reactive inflammation comes on and lasts ten days, then the operation is repeated, the patch of bone heals, the perforation closes. Hearing distance on discharge: watch 3'', low voice 10'. Two months later, at the end of January, 1877, the favorable state of the ear still lasted; hearing could not be further improved, on account of the chalky deposits.

CASE XIX.—Scar in the membrana tympani. Spots of carious bone in the posterior inferior quadrant. Cure after six weeks' treatment. Time of observation, 1 year.

Louise V., 12 years old, from Bockenheim, came under my charge February 14th, 1876. This girl, otherwise well, has suffered for several years from occasional pain in the ear, tinnitus, and deafness, *right*. Hearing distance: watch $\frac{1}{2}$ '', low voice 0, loud voice 6'. There is a slight purulent secretion in the external auditory meatus; the membrana tympani is irregularly curved, somewhat inflamed, and a yellowish secretion shines at some spots from out the tympanum; a translucent scar is visible in the posterior inferior quadrant. A granulation, half the size of a pea, rests on the annulus tympanicus, upward and outward from the scar.

As repeated cauterizations with the silver wire tipped with argenti nitras were of no avail in preventing a new growth of the granulation, the coarse patch of bone, now discovered, was scraped out with the sharp spoon. An attack of fainting came on and lasted ten minutes; however, the cure by instilling carbolic acid went on so favorably that in ten days the whitish scar in the bone was plainly seen. The sub-acute inflammation of the middle ear, going on at the same time, healed likewise by the use of Politzer's method. The membrana tympani showed more regular curvature, the light spot came back to view, the hearing increased to nearly normal, and remained constant.

CASE XX.—Tough, cock's-comb-like growths, resting on a carious base in the posterior inferior quadrant. Cure after three weeks' treatment. Time of observation, 9 months.

H. L., 21 years old, merchant of Frankfort, has been deaf, *left*, since childhood. Within a few days (April, 1876), there has been pain and also tinnitus, also somewhat increased purulent secretion for a year and a half. Hearing distance small: watch $\frac{1}{2}$ '', loud voice 4'. There

are offensive collections in the external auditory meatus, made up of cerumen, pus, and epidermis, and resting on the inflamed, reddened, and swollen membrana tympani. On using Politzer's method, after syringing these masses out, the air hisses through. Improved hearing follows: watch 2'', loud voice 18'. The cock's-comb-like growths are now distinctly seen in the posterior inferior quadrant, resting on the annulus tympanicus.

After the subacute stage of the otitis was cured, the growths were cut off, the spots of bone recognized as carious had to be scraped out twice, and then carbolic acid was instilled without any reactive inflammation. Even within three weeks, both the wound of the bone and the small perforation were healed. The hearing distance remained slightly reduced: watch 3'', low voice 10', loud voice 28'.

CASE XXI.—Otitis media purulenta chronica with granulations. Spots of carious bone in the inferior wall of the tympanum. Relative cure. Time of observation, 1½ years.

H. S., 20 years old, a merchant from Ruhrort, came under treatment at the beginning of March, 1875. A sufferer for four years from an offensive discharge and deafness of the *left* ear, he had been treated unsuccessfully up to this time, with innumerable astringents and caustics. Hearing distance: watch 2'', low voice 0, loud voice 10'. A granulated mass, as large as a small pea, springs out from the tympanum in the posterior inferior quadrant of the membrana tympani, which is slightly swollen and relaxed. Air hisses through the perforation, after the mass has been removed with the sharp spoon. The hearing distance at once increased: watch 3'', low voice 10'. Eight days later, the growth had sprung out again; a repeated removal was of no good, the secretion from the tympanum remained muco-purulent; the pedicle of the growth was stroked with argenti nitras in substance, but no noteworthy inflammatory reaction followed. After waiting for several weeks, my opinion now being that the carious spot was to be sought for on the inferior wall of the tympanum, near the annulus tympanicus, I decided to pass the sharp spoon (cutting surface downward) through the perforation, into the tympanum, and then to scrape. There was an abundance of small necrosed particles of bone in the contents of the spoon. Eight days later, the operation of scraping had to be repeated. Instillation of carbolic acid, no inflammatory reaction. The secretion lost its vile odor, became viscid, stringy, and stopped after pulv. alum had been blown in about six times. The old perfora-

tion, about as large as a small pea, remained ; the hearing distance increased to watch 6'', low voice 20'.

R. F., engineer, 24 years old, offers a very similar sketch, only there were small patches of carious bone *on both sides*, in the posterior inferior quadrant; the deafness greater (*right* : watch 1'', low voice 4'; *left* : watch 0, low voice 2') but gradually increased, after eight weeks' treatment. *Right* : watch 5'', low voice 25'; *left* : watch 4'', low voice 16'. Healing of bone, and secretion of cerumen followed.

CASE XXII.—Scar in right membrana tympani; left, defect, with granulating growths in the posterior inferior quadrant; tinnitus and attacks of vertigo. Relative cure. Time of observation, 9 months.

Louis B., 47 years old, a castellan, came under my charge at the beginning of July, 1876. He had often suffered in childhood from inflammation of the ears and deafness; *right*, there has been no suppuration for years, but the moderate lessening of hearing has been constant; *left*, the suppuration has increased excessively within the last four weeks, and is very offensive. Latterly, the patient has complained exceedingly of headaches, violent attacks of dizziness and tinnitus.

State : a moderately extensive scar in the posterior superior quadrant of the *right* membrana tympani, which is drawn inward. The hearing distance is : watch 4'', low voice 12'. *Left* : hearing distance, watch 0, loud voice 6'. A raspberry-like granulating mass, as large as a bean, in the bottom of the auditory meatus, and an offensive secretion. This growth is snared off, and its pedicle is seen to spring from the floor of the cavity in the posterior inferior quadrant. The anterior superior quadrant of the membrana tympani remains intact. After removal of the masses, the patient was, to be sure, noticeably relieved, but the attacks of vertigo returned, the granulations again grew from the floor of the tympanum outward, and probably caused a pressure on the fenestra rotunda. The spots of bone on the inferior wall of the tympanum, recognized as carious, had to be scraped out three times. Latterly the suppuration has diminished, the granulations have not returned, tinnitus and attacks of giddiness have disappeared. The lining membrane of the tympanum is yellowish-red. Hearing distance : watch on contact, low voice 2', loud voice 10'.

CASE XXIII.—Defect in membrana tympani. Spots of carious bone

at the superior border of the posterior inferior quadrant. Relative cure after eight weeks' treatment. Time of observation, 7 months.

J. S., 26 years old, a butcher of Kalbach, suffered from childhood up from otorrhœa on both sides. *Left*, the suppuration has been dried up for several years, and chalky deposits are visible in the membrana tympani; on the other hand, the discharge has increased much in the last months, *right*, and is very offensive. A raspberry-like growth, as large as a pea, in the bottom of the auditory meatus was snared off. The hearing on both sides was much reduced; on the *left* side, because fresh, subacute inflammation of the middle ear was present; *right* (before removal of the growth): watch 2'', low voice 6'; *left*: watch on contact, low voice 2'. After removing the growth, *right*, a kidney-shaped defect, occupying one-half of the membrana tympani, was seen. As the suppuration did not stop after the operation of removal, the carious spot of bone lying towards the middle of the posterior half of the annulus tympanicus, and from which the growth has started, was scraped out four times, at intervals, each time, of eight days. No inflammatory reaction followed the instillation of carbolic acid, and after eight weeks of treatment, the scar in the bone was plainly seen, the secretion became inconsiderable, and viscid. Five months later, there was a secretion of cerumen.

The operation on patches of carious bone in case of tuberculosis is less successful, as the state of circulation of blood in the periosteum and substance of the bone itself is unfavorable; relapses and profuse suppuration are therefore frequent. Of the two following cases, the second is of predominating interest, because from the deleterious course of an affection of the ear, originating in a seeming state of perfect health, we must conclude that there is present a severe constitutional disease, for which, however, in the first period, in so far as the lungs were concerned, all physical symptoms were wanting.

CASE XXIV.—Tuberculosis of lungs, otitis media, with spots of carious bone in the posterior inferior quadrant. Improvement.

J. S., 18 years old, from Trier, now at the neighboring spring on account of an infiltration of the upper portion of the left lung, consulted me in July, 1876. The otitis media had begun acutely, four months before; at first the suppuration was moderate, now it is very profuse

and offensive. The *left* membrana tympani is relaxed, reddened, and there is a perforation as large as a lentil, with granulations springing forward from it, in the posterior inferior quadrant. Hearing distance: watch 2'', low voice 4'. After removing the granulations, the small spot of bone recognized as carious was scraped out; under after-treatment with Politzer's method, and solutions of argenti nit., the membrana tympani cleared, the secretion became more viscid and inoffensive; the granulations had not grown again during four weeks' treatment. Hearing distance had increased to, low voice 16'. Farther course unknown.

CASE XXV.—Acute necrosis of portions of the tympanum, both sides. Development of tuberculosis of the lungs. Loss of hearing.

R. E., hospital assistant, 21 years old, came under my charge Nov. 7th, 1876. The young man, hitherto healthy, entered the military service a year ago, as a volunteer for three years. In September, after a very damp night watch, he was attacked with symptoms of an acute otitis media, both sides. In the sixth week after beginning of the attack, I found the periosteum of both auditory meati swollen, very painful, and only a small portion of the loosened and livid-looking membrana tympani visible. On using Politzer's method, the air hissed freely through perforations on both sides. The hearing distance was already slight; *right*: watch 0, loud voice 4'; *left*, watch barely on contact, loud voice 6'. After a fortnight's treatment with the air douche and solutions of argenti nit., the view into the deeper parts became more free, and I distinguished, *right*, a coarse exuberating granulation, which swelled forward from the inferior wall of the tympanum, out through the perforation; the posterior part of the membrana tympani was excessively curved forward (probably also due to granulations). When I cut off the growth, I found already some black particles of bone in the hollow of the spoon, the air hissed more freely through, but the hearing did not increase. Nine days later, the partially discolored granulations had again grown out from the floor of the tympanum, tinnitus and attacks of vertigo (probably due to the pressure of the masses on the fenestra rotunda) had increased. *Left*, granulations likewise showed themselves in the perforation. These were yet once more carefully cut off (both sides) with the sharp spoon, tinnitus and attacks of vertigo diminished. In spite of this the hearing decreased rapidly.

Such an unfavorable course of the local process of disease could only be explained by the accompaniment of a constitutional disease, and, to be

sure, just at this time, more distinct symptoms, even on the part of the lungs, became noticeable. By the middle of November, the patient had moderate feverish chills, cough at night, and some expectoration. Still the examination of the lungs did not yet divulge any distinct dulness, but there were some rattling râles at various spots. The patient looked miserable, lost flesh rapidly, and on December 5th, dulness of the apex, *left*, could be now confirmed. About this time, too, I recognized with the sound extensive patches of carious bone in the posterior inferior quadrant *on both sides*, and the chain of small bones seemed already loosened. I therefore desisted from farther operations, and only used Politzer's method, and the instillation of carbolic acid. The hearing was now so slight that we could only in writing make ourselves understood by the poor patient; in this inconsolable state, he was sent home by the military authorities, at his own request, in December. The physician in charge wrote to me at the end of January, in regard to the farther progress of the case, and said that feverishness was continually present, dulness over the lungs had increased, and the patient was totally deaf.

From these cases which I have reported, we gain the fact that the use of the small sharp spoon, and especially in the shape which I first* described, and the operation for which it

* The various reviews which have appeared since the publication of the first half of this paper express themselves mostly in assent; while, *e. g.*, the Wiener Medic. Wochenschrift, 1876, No. 28, page 701, says: "The *procedure put forward by Wolf* is to be regarded as an advance in the local treatment of diseases of the ear, not to be underrated;" yet I found in the Archiv für Ohrenheilkunde, which Prof. Schwartze edits, the following remarkable sentence by Dr. Jacoby (Band xi., Heft 3 and 4) "The procedure recommended by Wolf for the cure of caries in the ear (*which, however, has been frequently used by Prof. Schwartze, and is also repeatedly mentioned in his cases of surgical opening of the mastoid process—e. g., Band xi., page 139, 150*) is absolutely judicious, etc."

Leaving out of consideration that Schwartze's publication appeared July 21st, 1876, that is to say, six months *later* than mine, his operation, according to the page cited (139) is as follows: he first makes a large incision in the skin over the mastoid process, opens that with a trepan or gouge, and clears out the mastoid cells with the common surgical sharp spoon. The kind reader will, on making comparison, be unable to find even the most distant resemblance between this proceeding and mine, and so far as I am concerned, I can only explain the oracular expression in question, of Dr. Jacoby, in that he most warmly wishes that Prof. Schwartze *had been the first to discover* the method.

is to specifically used, has undoubtedly given rapid and favorable results in all the cases in which tuberculosis was not the cause of the disease of the ear. Healing of the formerly carious part of the petrous portion of the temporal bone was gained even in patients affected with constitutional scrofula, whenever the local treatment was sufficiently aided by fit general treatment directed against the dyscrasia. In such cases, the fresh bone showed itself, in all respects, more capable of healing than that full grown; as the former is more easily affected than the latter, so it can also regenerate more quickly after removal of the necrosed portion.

In order not to weary the reader too much with an enumeration of the most varied cases, I have collected chiefly those cases which, leaving the operation out of the question, also offered many interesting points, but I should never hesitate to communicate cases resulting unfavorably, if such had happened, with exception of those becoming deaf through tuberculosis. Up to this time, none of my operations have offered any harm to life or hearing, and I cannot therefore too urgently recommend the right frequent use of the little instrument to my colleagues.

OTOLOGICAL REVIEW.

By CLARENCE J. BLAKE, of BOSTON.

1. KUHN. Untersuchungen über das häutige Labyrinth der Knochenfische. *Archiv f. Mik. Anat.*, XIV., 264.

2. HARTMANN. Function der Tuba Eustachii. *Archiv f. Anat. und Physiologie*.

3. KRAUSSOLD. Primäre Otitis ext. Diphtheritica. *Centralblatt f. Chir.*, No. 38, 1877.

4. SCHWABACH. Nystagmusartige Augenbewegungen in Folge eines Ohrenleidens. *Zeitschr. f. prakt. Med.*, No. 11, 1878.

5. LADREIT DE LACHARRIERE. De l'influence du tabac sur le développement des maladies de l'oreille et la surdité. *Annales des Mal. de l'oreille et du larynx*, Sept., 1878.

6. HARTMANN. Ueber eine neue Methode der Hörprüfung mit Hülfe electrischer Ströme. *Monatschr. f. Ohrenheilk.*, XII., 7.

7. GALTON. A Form of Whistle for Testing the Hearing for high Musical Tones. *Physical Society Proceedings*, London.

8. ZAUFAL. Ueber die allgemeine Verwendbarkeit der kalten Drathschlinge zur Operation der Nasenpolypen, nebst Bemerkungen über das Abhängigkeits-Verhältniss der Erkrankungen des Ohres von denen der Nase. *Prag*, 1878.

9. BEZOLD. Fibrinöses Exsudat auf dem Trommelfell und im Gehörgang. *Virchow's Archiv*, LXX., 3.

10. KIRK-DUNCANSEN. One Hundred Cases of Ear Disease. *Edinburgh Med. Journal*, Mar., 1878.

1. Kuhn in an elaborate paper describes with especial minuteness the histological structure of the terminal nerve portions of the labyrinth in osseous fishes.

In the membranous labyrinth the terminations of the nervus acusticus are eight in number; namely, a macula acustica each in the utricle and saccule, the papillæ basilares of Retzius in the utricle lying near the ramus communicans, a crista acustica in each of the three ampullæ

and another crista acustica in the lagena, the analogue of the cochlea in the higher vertebrates. From these nerve endings the macula acustica utriculi and sacculi and the crista acustica lagenæ are each separated by an otolith.

The nervus acusticus divides into a portio vestibularis and cochlearis, the former supplying the macula utriculi, the two papillæ basilares, the crista ampullæ horizontalis and sagittalis, and the latter the macula sacculi, the crista ampullæ frontalis and lagenæ.

The macula acustica utriculi lies at the bottom of the recessus utriculi in the form of a crescentic ridge 3 mm. long, and is composed of three forms of cells.

Undermost are the basement cells, round nucleate cells lying in a simple layer upon the cartilaginous wall of the utricle; then filiform cells, oval nucleate cells having two diametrically opposite filiform processes, the uppermost of which extends to the free surface of and sometimes beyond the overlying layer of cylinder cells, while others enter the lower pointed end of the cylinder cells. In one case the filiform process was followed into the nucleus of one of the cylinder cells. The third and uppermost layer of the macula acustica is formed of the large round-nucleated cylinder cells, the lower end of which terminates in a filiform process, the flattened upper surface being crowned with a circle of delicate hair-like structures. The nerve-fibres passing to the macula acustica enter the filiform cell-layer as double contour nerve-fibres, then become filiform and form between the basal and cylinder cells a fine network from which spring the processes of the filiform cells. On the macula utriculi rests a globular otolith having a roughened surface and supported by an elastic fibrous basal substance. The otolith is imbedded in a transparent glutinous mass, in connection beneath with a striated membrana tectoria which covers the whole surface of the macula.

On the whole the structure of all the nerve endings and the entrance and distributions of the terminal nerve-fibres resembles that of the macula utriculi; the only marked variations are found in the covering of the cristæ acusticæ and in the form of the remaining otoliths.

On the surface of each crista acustica lies a structureless cuticular membrane which is penetrated by the hairs of the cylinder cells; over this lies the cupula terminalis, a globular, transparent and, when fresh, semi-solid mass which, covering the entire crista, lies directly upon the cuticula.

The latter is made up of fine fibres placed perpendicularly to the crista, but approaching the centre at the apex of the cupula; the upper surface of the cupula is covered by a structureless membrane.

In the sacculus lies the otolith "*Sagitta*," of the same structure as the "*Lapillus*" above described, and imbedded in a similar glutinous mass. The posterior end of the sacculus is continued in the lagena, on the crista lagenæ lies the third otolith "*Asteriscus*," similar in structure and attachment to the others.

2. Hartmann, following the experiments of Lucae, determines manometrically the degree of pressure necessary to inject air under varying conditions of the Eustachian tube.

By previous observations* he had determined that at +V, the muscles being in a state of rest, air found entrance at a pressure of from 20 to 40 mm. Hg., and that during the act of swallowing 20 mm. and less was sufficient, in other words that the Eustachian tube was correspondingly open. In reviewing these results, he concludes that the pressure given is too low, as it is not always possible to maintain the muscles of the Eustachian tube at rest. In order to test the correctness of this surmise he repeated the experiments in the pneumatic cabinet. The results of the experiments, conducted upon himself and two colleagues having normally patent Eustachian tubes, showed that at +V there was no absolute rest of the tubal muscles. The entrance of air being rendered easier: on increasing the pressure painful sensations, impression and congestion of *membrana tympani* were produced, and during the act of swallowing these symptoms disappeared. On diminution of the pressure, air passed out of the tympanic cavity with a marked sensation of the passage of air bubbles. Hartmann concludes therefore that much less pressure is required for the exit of air from the tympanic cavity than for its entrance, which he explains by supposing that the Eustachian tubes at rest are like valves opening toward the pharynx. By contraction of the tubal muscles in consequence of phonation during increasing pressure in the cabinet, air did not enter the tympanic cavity. He denies, therefore, that the tubes open during phonation, but concedes that the passage of air is more easily effected.

The case is cited also of one of the gentlemen taking part in the experiments, in whom the Eustachian tubes were open in a state of rest, and in whom the *membrana tympani* was pressed outward by a pressure of 10 mm. Hg.

* Virchow's Archiv, lxx.

Movements of the membrana tympani were also visible during forcible respiration, and the entrance of air into the tympanic cavity during phonation was also noted; these symptoms did not occur in the pneumatic cabinet.

3. Wreden and Moos, following the observations of Bezold on cases which he designated as diphtheritic inflammation of the external auditory canal and membrana tympani, have reported other cases similar in character and pointing to the conclusion that the membrane formed is of primary origin.

Kraussold, however, is not of the same opinion, and maintains that it is not possible to determine the presence of a diphtheritic inflammation of the auditory canal without previous lesion. Secondary diphtheritic inflammation of the middle ear may extend through a perforation of membrana tympani to the outer surface of the membrana tympani and the lining of the external auditory canal, but it is impossible that diphtheritic inflammation should occur primarily in the previously healthy lining of the external auditory canal. In support of this view the following case is cited:

A young woman, 22 years of age, had for some weeks a slight otitis externa with serous discharge; this was followed by general disturbance, severe pain in the right ear, tinnitus, deafness and feeling of fullness on the right side of the head.

The right auditory canal was nearly filled with a grayish mass, apparently of epidermis which could be removed neither by syringing nor, on account of the tenderness of the parts, by the forceps. The watch was heard only at a distance of $\frac{5}{8}$ cm.

The air douche gave coarse râles and some pain, but did not improve the hearing. On removal of a portion of the mass plugging the meatus, the walls of the canal were found to be red, swollen, tender, and excoriated in patches. Evening temperature was 38.7° C. The mass removed was not examined, as it was supposed to be merely epidermis.

On the following day, the symptoms were the same, and the surface from which the coating had been removed, was covered by fresh exudation. This first led to the inference of a diphtheritic inflammation, which was further supported by the fact of an epidemic of diphtheria in the city. There was, however, no evidence of direct infection. On the fifth day, there was removed, by means of the forceps, a mass resembling the finger of a glove and about 14 mm. long, the extremity

of which corresponded to the superior segment of the membrana tympani. The membrane was gray, dense, and elastic, and left an excoriated surface behind it. Three days later, this surface was again covered by fresh exudation which was removed seven days later, small portions being subsequently removed by injection of a solution of salicylic acid. The hearing, which had improved on the removal of the mass, was still further increased by the use of the air douche, and the subsidence of the inflammatory symptoms.

Under the microscope were found delicate reticulated fibres and a few round cells, and on the edges of the mass, pus and epidermis cells. Typical micrococcus masses were not observed.

4. Schwabach reports a case of otitis media purulenta, accompanied by profuse discharge, with swelling and tenderness over the mastoid, severe vertigo upon pressure upon the ear, and in addition the following curious symptom.

Upon pressing above and behind the auricle, the flow of pus was increased from the external auditory canal, without increase of pain, but with marked oscillatory movements of both eyes, the eyes being turned toward the affected side and slightly downward, the size of the pupils remaining unchanged.

These movements ceased so soon as the pressure was removed, but were repeated in a lesser degree on syringing the ear. These movements were accompanied by vertigo as above mentioned. With the improvement in the disease of the ear, these peculiar symptoms gradually diminished. The author bases his explanation of the contraction of the muscles of the globe upon the experiments of Cyon upon rabbits, and assumes an irritation of the semicircular canals, in consequence of the pressure exercised upon the ear. The transmission of the irritation to the cerebral motor centres corresponding to the muscles is unexplained. The frequency of the oscillations was from twenty to one hundred and fifty in the minute; their duration depended upon the pressure, but seldom exceeded half an hour.

5. References to the effects of tobacco in works on aural surgery are rare, and are principally confined to a consideration of its general effect upon the nervous system.

Lacharrière, however, makes a more special mention of the bearing which the habitual use of tobacco may have upon diseases of the ear through the organs of the tympanic cavity, the muscles of the pharynx and palate, and the nerves of this region and of the ear. The

consumption of tobacco by smoking the author considers the most deleterious form of use, so far as this special effect is concerned, as the large tract of the buccal, nasal, and pharyngeal mucous membrane, and even the lining of the Eustachian tube is exposed to its influence, the resultant appearances being those familiarly described as "smoker's throat," which is pictured in detail, with the auditory symptoms, those resulting from occlusion of the Eustachian tube, and slight persistent congestion of the tympanic mucous membrane. The muscles of the pharynx also in time become affected and by a diminished fulfilment of their office more readily permit the closure of the Eustachian tube. The second period is characterized by a sensorial depression, the deafness is confirmed, but the subjective noises increase, while the third period is characterized by a progressive paralysis of the auditory nerve.

6. In experiments upon the use of the telephone as a hearing test, Hartmann made use of the following combination.

A tuning fork, 100 vs., to be used as interruptor, was kept in vibration by the current from two Daniell's cells. For the first experiment, the circular compensator of Du Bois-Reymond was interposed, and connection made by twenty metres of wire with a telephone. On diminishing the resistance in the connection with the compensator, the stream passing rhythmically through the telephone was correspondingly diminished. Remarkably short wires (corresponding to weak currents) sufficed to produce the tone in the telephone, and in the compensator used it was not possible to so far diminish the resistance as to make the telephone inaudible. A few millimetres of the wire, one millimetre in diameter, sufficed to notably increase the sound, and a few centimetres of the same wire brought it to its maximum.

For the experiment with the induced current, the tuning fork was placed in the primary coil of a Du Bois-Reymond induction coil, the secondary coil being connected with the telephone by twenty metres of wire. The apparatus employed, medium size, having 5116 windings on the secondary coil, reproduced the tone in the telephone with disagreeable loudness. On withdrawing the secondary coil, the loudness of the tone diminished, and became inaudible in a quiet room only when the secondary coil was withdrawn more than sixty centimetres from the primary coil.

7. As an additional means of testing the hearing for high musical tones, Mr. Galton has devised an exceedingly simple and ingenious

whistle, consisting of a brass tube with the reed opening terminating in a small circular resonating chamber, having a female screw at its lower end. A foot piece with a corresponding male screw fits with a metal casing into and over the bottom of the resonating chamber. On the summit of the male screw is a metal rod which accurately fits the inside of the resonating chamber. The outside of this chamber is marked off in degrees from 0 to 140, and the rim of the casing of the foot-piece is marked off from 0 to 9. The whistle being blown by a small rubber bag, each revolution of the foot-piece upward diminishes the calibre of the resonating chamber and increases the pitch of the whistle, until at 0. 0. the tone has become inaudible to the average normal ear. The instrument is very compact and may be used to supplement the tests with König's rods.

8. In an interesting paper, which is in part a résumé of a portion of his former communications on the subject, Zaufal directs attention to the intimate relation which pharyngeal disease bears to middle-ear affections, both acute and chronic, and to the importance of a knowledge of the normal and pathological anatomical relations of the nose and naso-pharynx in studying the etiology, diagnosis and treatment of middle-ear disease, and notes many important details in regard to methods of examination and of treatment. In regard to the principal subject of the paper, he remarks with justice the insufficiency of the merely rhinoscopic examination and of the removal of nasal polypi by means of the forceps.

The introductory portion of the paper is followed by a description of the gross appearances of nasal polypi and of the hypertrophied portions of the mucous membrane covering the middle turbinated bone with which the former growths may be confounded. For differential diagnosis as to depth and color, he advises the use of the nasal speculum, and for determination of position, size, and consistence, the use of the probe.

In ninety-five per cent of all cases, the growths are found to be mucous polypi. All of these may be removed by means of the simple wire, galvano-caustic being required only for the removal of fibrous growths and the hyperplastic enlargements of the mucous membrane above mentioned.

Following a description of the modified Blake snare is a description of the method of operation, including cautions with regard to the danger of including the swollen mucous membrane in the loop—an accident

which often results in profuse and annoying bleeding; to avoid this, the loop should be passed obliquely from without inward over the outside of the polypus, and should be of a size to include the growth only. The seizure of deeply-seated polypi is facilitated by making the patient expire forcibly through the nose at the moment of application of the snare; when mucous membrane has been included in the loop by mistake, the wire may be cut at the outer end of the tube of the snare, and the wire withdrawn.

In cases of extremely narrow nasal passages, or where the swelling of the mucous membrane interferes with the introduction of the instrument, and with proper illumination, he advises the introduction of cotton plugs which are allowed to remain for about ten minutes, their removal being immediately followed by the operation.

In long standing cases, accompanied by abnormal sensitiveness of the parts, the growths should be removed piece-meal, but where the growth is tough and fibrous, it may be torn away with a coarser wire.

For after-treatment the base of the polypus should be energetically cauterized, either with chloride of zinc or nitrate of silver, the latter either pure or, as recommended by Hedinger, fused with nitrate of potash. The cauterization should be repeated every third or fourth day during a period of from two to four weeks, either by the above method or by means of galvano-caustic.

9. Bezold reports three cases of croupous exudation coming under his observation during the past year. In each case there was repeated formation of a fibrinous exudation upon the lining of the external auditory canal and upon the membrana tympani. The false membrane differed from that in the cases reported by Moos, Wreden, Wendt, and Callan in that it was easily removable, that there were no signs of granulations, and no suppuration after its removal; and it is of especial interest that in all the specimens of the pseudo-membrane large quantities of micrococcus were found.

The symptoms in all three of the cases were much as follows :

Without fever or other marked preliminary symptoms, there occurred, either spontaneously or in the course of some other inflammatory affection, fibrinous exudation upon the surface of the membrana tympani and the lining of the external auditory canal. The removal of this membrane was easily accomplished, either by means of the forceps or syringe, but was always accompanied, especially in the earlier stages of the disease, by more or less pain. This exudation recurred usually at

intervals of two or three days, and the surface upon which it had spread itself appeared, especially after the first removal, swollen, injected, and slightly excoriated. After the cessation of the exudation process, recovery progressed rapidly without cicatrization or other lasting evidence of the past disease.

This pseudo-membrane was distinguishable from the common layers of epidermis by its yellowish sodden appearance, and by its elasticity. Microscopically, it presented the appearances which characterize the membranes occurring in the larynx in croup; namely, a fine fibrous network, including round cells, nuclei, epidermis, and micrococcus.

In describing the differences between these cases and those of Moos and Wreden, Bezold bases his opinion as to the croupous nature of his cases upon the delicacy and vascularity of the epidermoid covering of the lining of the external auditory canal, which would permit, under sufficient irritation, the occurrence of a form of inflammation usually peculiar to mucous and serous membranes.

Bezold doubts the etiological importance of the presence of micrococcus, and concludes his paper with a contribution from Dr. Schoeninger (assistant in the Munich Pathological Laboratory), who is of the opinion that the micrococcus was present at the time of the occurrence of the exudation and developed as a secondary accidental symptom.

10. Among one hundred cases of aural disease reported by Dr. Kirk-Duncansen, the following are especially interesting.

A patient with rudimentary auricle, the auricle being represented by a longitudinal elevation of the skin, upon which was a process corresponding to the lobule, and in place of the external auditory canal a simple depression. On this side the hearing was absent, the other ear was normal.

Malignant growths occurring in a case of purulent otitis media complicated by mucous polypi, long under treatment. The malignant growths distending the external auditory canal, implicating the auricle, and accompanied by intense pain. These growths were frequently removed, recurred readily, and finally terminated fatally.

A membrane simulating the membrana tympani, and closing the external auditory canal at a point midway between the meatus and membrana tympani in a boy sixteen years of age.

Two cases of hereditary syphilis, in which the ears first showed symptoms of disease at the time of puberty.

A case of otitis media hypertrophica, in which the severe tinnitus was finally relieved by prolonged administration of muriate of ammonia.

Four cases of deaf-mutism, in one case the result of secondary cerebral tumor.

